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ABSTRACT

This book provides an introduction to earnings capacity (EC), a measurement of human capital, and its application to a research study of potential earned annual income over a 25-year period. Focus is on qualitative aspects of EC such as race, age, gender and education and its utilization. Chapter 1 is an introduction. Chapter 2 reviews existing measures of economic potential, such as gross domestic product. Chapter 3 presents a series of questions about human capital and its measurement. Chapter 4 is a literature review. Chapter 5 defines and describes the EC estimation tool, the sample studied, and the time frame. Chapter 6 presents research findings of the estimation of the level and trend of aggregate EC since 1975, relating those findings to education and involuntary as well as voluntary unemployment. Differences between the latter two conditions in terms of economic and social implications are discussed. Chapters 7 and 8 presents patterns of human capital levels and trends, utilization, and the sources of unutilized human capital by subgroups of the population. Chapter 9 is a summary and conclusion with additional material on human capital utilization of minority youths and the older working-age population. There are 70 figures and tables. The bibliography lists 91 references. The 3 appendices include procedures for estimation of EC and attribution of unrealized potential earnings to its sources. (AJ)

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# Human Capital in the United States from 1975 to 2000

## *Patterns of Growth and Utilization*

Robert H. Haveman, Andrew Bershadker, and Jonathan A. Schwabish

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# Human Capital in the United States from 1975 to 2000

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## Patterns of Growth and Utilization

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# Preface

The roots of this manuscript go back over 20 years to the first published appearance of the Earnings Capacity (EC) indicator, which in turn grew out of an immense body of literature on human capital. The purpose of this volume is to demonstrate the importance and usefulness of EC in measuring the size and strength of the American economy. Ultimately, an economy is only as strong as the individuals that comprise it, and we suggest that the EC indicator is useful for measuring the human capital embodied in various segments of the population. We pay special attention to at-risk groups, including women with children and individuals with low education, in order to highlight the social and public policy relevance of the EC indicator. We hope our work will prove to be a useful tool for researchers and policymakers alike.

We have drawn upon the aid and guidance of numerous people over the course of this project. The assistance of researchers at several federal government agencies was key in developing and understanding the methodology behind the indicators described in Chapter 2, including Robert Arnold, Charles Gilbert, Gloria Gloings, Shelby Herman, Bob Ritterbeck, Larry Rosenblum, and Steve Rosenthal. We would like to thank several people whose comments and insights we relied upon, including Irv Garfinkel, Nancy Folbre, Raja Junankar, Brian Knight, Robert Moffitt, Karen Pence, Isaac Rischall, Timothy Smeeding, Orlando Sotomayer, Geoffrey Wallace, and Barbara Wolfe. Larry Buron and Owen O'Donnell were there at the start, and contributed much to the foundations of this work. Valuable research assistance at various stages was provided by Cullen Goretske, Kristen Grunow, and David Reznichek. Dawn Duren and Betty Evanson have helped us in the editing and formatting processes, and Joyce Collins and William Wambach have given us valuable administrative support. Finally, a number of individuals at the Upjohn Institute gave us comments on an earlier draft of the manuscript. In addition to seminar participants at Upjohn, we would like to thank Kelly DeRango, Randall Everts, Kevin Hollenbeck, and Stephen Woodbury. Richard Wyrwa, also at Upjohn, was crucial in overseeing the production of the final manuscript. We gratefully acknowledge funding from the Institute for Research on Poverty and the Robert M. La Follette School of Public Affairs of the University of Wisconsin–Madison, the Jerome Levy Economics Institute of Bard College, the Russell Sage Foundation, and of course, the W.E. Upjohn Institute.

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# 1
# Introduction

## HUMAN CAPITAL: CONCEPT AND MEASUREMENT

A veritable army of statisticians and analysts carefully monitor and document the performance of the U.S. economy. Their reports rely on a standard set of economic indicators, such as Gross Domestic Product (GDP) and its growth, the unemployment rate, new jobless claims, and the rate of productivity growth. Digging a bit deeper, one would find statistics and reports on the capacity utilization rate in the manufacturing sector, the level of employment, or the number of job vacancies that are advertised. These statistics and the reports based on them help shape our views of the state of economy and future economic prospects. Surprisingly, however, these commonly cited measures do not provide a comprehensive description of the magnitude of the nation's productive resources because they do not fully value the potential and the actual inputs of people into the nation's productive processes.

The nation's labor and physical resources are its primary inputs into the production process that is the U.S. economy. While we do an excellent job of measuring and reporting on the level and utilization of the nation's physical capital, national statistics on the available productive contributions of the nation's workers are far less adequate. The contribution of workers and their skills—that is, the contribution of *human capital*—to the economy rests on the number of people that are available to work, the share of the available workers who are employed, and the distribution of the skills and productivity of these workers. However, most national statistics describing the contribution of human capital to the economy are simply counts of people—for example, the number of people in the labor force or the number of people employed. While these statistics accurately summarize the number of people who are working or looking for work (the labor force) and the employment status of these workers, they convey little regarding

the value of the potential or actual contribution of these people to the nation's output.

The goal of this study is to enhance existing measures of the nation's human capital and the extent to which that capital is utilized. We think of the nation's human capital as the value of the labor resources that are embodied in its working-age citizens. These resources—in particular, the hours of labor time that people have available to be used in productive activities—can be allocated in many ways to produce things of value. Indeed, it is the value of this "output" that gives value to these labor resources.

In our analysis, we develop an indicator of the value of the human capital stock held by the nation's working-age population. We call this indicator *earnings capacity* and refer to it as EC throughout the monograph. We use it to study the time trends (from 1975 to 2000) in aggregate human capital in the United States and human capital per worker. We also use our EC measure to evaluate the *utilization* of the nation's human capital stock. We explore these patterns for the entire working-age population, as well as for subgroups distinguished by race, schooling, and age. Thus, our empirical results provide insight into the performance of the U.S. economy over the past three decades, and they serve to supplement other analyses of this performance.

How is EC an indicator of the nation's human capital stock? A comprehensive measure of the value of human capital of the nation's potential workers would be the value as of today of the entire future stream of productive services of the existing working-age population. Thought of in this way, the value of the human capital stock is analogous to value of the nation's physical capital stock. Indeed, in valuing the stock of physical capital (i.e., the nation's factories, machines, and equipment), the analyst calculates today's value of the stream of potential outputs attributable to this physical capital over its lifetime. This "asset value" reflects what this capital stock would fetch on the market if it were sold. In a parallel way, the value of the human capital stock is the discounted present value[1] of the stream of outputs attributed to the potential productive activities of the nation's citizens. If we had an estimate of this value for each working-age person, we could sum these individual values and obtain a measure of the nation's human capital stock.

Our indicator of human capital—EC—is not this full "discounted present value" for the existing population of potential workers. Rather, EC is equal to the annual value of the potential output of the nation's working-age population. In particular, it is the market value of the annual earnings that the working-age population would generate if it were used to its full potential.[2] We assert that this value is an accurate indicator of the full human capital stock measure, in much the same way that the annual value of the potential output attributable to the nation's stock of physical capital would accurately track the value of the stock of physical assets.

Measuring the flow of income from physical or human capital raises a number of issues. First, we must distinguish between the gross flow of income and the net flow. If we measure just the value of the potential income generated by a particular piece of physical capital, we measure the gross value of the annual outputs attributable to that capital. If we subtract the costs of operating and maintaining that capital, we measure the net value. Similar gross and net concepts can be applied to human capital. If we measure just the value of the potential earnings that a worker could generate, we measure the gross value of the services of his or her human capital. If we subtract the costs of "maintaining" that individual—food, clothing, shelter, etc.—we arrive at a net value measure. As we will see, our EC indicator is a gross measure of the potential annual return on human capital.

The second issue involves the distinction between the maximum value of earnings that can be generated from the stock of human capital and the value that is, in fact, generated. Here, we must introduce the notion of "potential," and again draw a parallel to physical capital. When statisticians and analysts present measures of *Potential* GDP, they describe the value of goods and services that could be produced (hence, the value of income generated) if the nation's stock of physical capital were used at its capacity. Similarly, our EC measure is a potential measure. It asks what annual earnings in the United States would be if all working-age individuals used their human capital at its capacity. The utilization of that stock is equivalent to the value of the goods and services actually produced by working-age people, that is, their actual earnings.

In order for this concept of potential earnings to serve as the basis for measuring the level of physical or human capital, the full (or capac-

ity) utilization of these resources must be specified. Such a specification is bound to be controversial. Take an industrial plant, for example; what is the capacity level of output of such a facility? One possibility would be the maximum level of output. Alternatively, we could seek to measure the plant's value when it is operating at an "efficient" level, where efficiency has some objective definition.[3] In most nations, researchers and national accountants have established an operational norm for measuring the potential operation of factories, machines, and equipment when attempting to measure the value of the nation's physical capital stock.[4]

In developing our indicator of the value of human capital, we specify the potential, or capacity, use of the time and skills of the nation's working-age population in a similar way. In particular, our EC concept rests on a widely accepted (though clearly debatable) standard of potential or capacity use of human capital, namely full-time, full-year (FTFY) work. Although this standard reflects an accepted standard of "capacity" work, it fails to count those productive activities of workers beyond this full-time norm.

Like measures of the nation's physical capital stock, the EC indicator of human capital relies on evidence regarding how the market values the flow of capital services, namely, the market price attached to them. In particular, we use the values of labor services observed in the labor market—wage rates—as our guide in valuing the potential services of human capital. In practical terms, then, EC is equal to the annual gross earnings that would be generated in the United States if all people of working age were to employ their skills, knowledge, and labor services in FTFY market work.[5] While the standard and regularly reported indicators of labor-market performance measure either the physical quantity of potential and actual labor services (e.g., the labor force, employment, unemployment, and hours worked) or the price of labor services (e.g., wage rates), EC captures in one indicator both the level of potential labor supply and the valuation of these services. For many questions, then, the EC measure is able to provide a richer and more comprehensive description of the actual and potential performance of the labor market than can these more commonly used indicators.

## OBJECTIVES OF THE STUDY

We have several objectives in undertaking this study. Most basically, we wish to document the level and growth of human capital in the United States. This "national accounting" purpose rests on the judgement that the stock of productive knowledge and skill that is embodied in the nation's working-age population is one of its most valuable resources. When human capital services are combined with the flow of inputs from the nation's natural resources and physical capital, a stream of final goods and services of value to the nation's citizens is generated. This stream is the nation's GDP. It follows that the human capital component of the nation's economic base must be accurately measured and recorded in order to understand the contribution of labor resources to the nation's output or GDP, as well as their contribution to potential economic growth—growth in GDP.

We present our measure of the nation's aggregate EC for each year from 1975 through 2000 and display this series in figures and tables. While the level and trend of the nation's aggregate human capital is of interest in its own right, because we use detailed information on several thousand individuals each year (weighted so as to represent the entire working-age population), we are able to assess the level and growth of EC for several socioeconomic groups, distinguished by gender, race, education, age, and family status. Such breakdowns enable us to compare the levels and trends in human capital among racial, gender, age, and family structure groups, as well as inquire into the source of these differing patterns.

A second objective of our study concerns the term "potential," mentioned above. The nation's actual GDP in any year reflects the extent to which the potential services from its physical capital and human capital are realized. Hence, it is important to measure the "utilization" of the nation's capacity to produce—the utilization of the nation's physical and human capital. While the utilization of physical capital has been studied extensively (see Chapter 2), far less progress has been made in measuring the utilization of human capital. Following our analysis of the level and growth of the value of potential human capital services, EC, we also study the extent to which this human capital is utilized. We develop an index of human capital utilization—a

capacity utilization rate (CUR)—that is analogous to standard measures of the utilization of the nation's physical capital stock.

Some of the most interesting questions we pose concern the extent to which particular gender, race, education, age, and family structure groups utilize their human capital, and how these capacity utilization patterns have changed over time. How do racial groups (or age, gender, or educational groups) differ in the extent to which they utilize their human capital? Again, because our analysis is based on information for the entire working-age population for each year, we are able to explore the differences in human capital utilization patterns among various groups of interest.

Having measured and tracked the level and composition of human capital over the last quarter century, and identified the primary patterns in the use of this human capital, we also seek to understand why the nation's stock of human capital is only partially utilized. In this analysis, we consider the role played by the macroeconomic performance of the economy, the health status of the population, and the extent to which people have voluntarily chosen to substitute other activities (e.g., retirement, even though of working age) for market work.

Finally, we focus attention on a set of particularly vulnerable population groups in the United States. These include both youths and older workers with low levels of schooling, as well as single mothers and other subgroups of specific interest to policymakers. We explore how the stock of human capital of these groups compares to that of the remainder of the population and how the capital stock of these vulnerable groups has grown or failed to grow. Generally, these vulnerable groups show a rather low level of utilization of their capital stock, and we study these level and trend patterns as well.

## THE PERFORMANCE OF THE U.S. LABOR MARKET OVER THREE DECADES: A BACKDROP

Our measures of EC and its utilization provide empirical evidence regarding various aspects of labor market performance, in particular the available supply of human capital and the extent to which human capital is employed in the formal labor market. This evidence supple-

ments existing statistical series and research studies in presenting a picture of the overall operation of the nation's labor market.

In this section, we briefly review the performance of the labor market in the United States since about 1970. In particular, we summarize U.S. trends in employment, labor force participation, part-time employment, and hours worked—all physical measures of various aspects of the supply of labor services. We also describe trends in the level and distribution of real wages, describing the payment for work done.[6] This background provides the context for our discussion of the level and trend of the nation's human capital and its utilization, and it will allow us to nest our findings in the previous literature on the past performance of the labor market. It will also enable us to assess the value of the additional insights into the performance of the nation's workforce that the EC concept provides.

The performance of the labor market during the 1970s and the 1980s differs in many ways from that of the decades that preceded it, and from the expansionary period of the 1990s that followed it. Hence, in some of our discussion, we distinguish the period from the early 1970s to the end of the recession of the early 1990s from the expansion that followed 1992.

**Employment Ratio**

The U.S. employment–population ratio[7] has followed a steady upward trend over the post World War II period (Summers 1986). Indeed, total employment increased by 60 percent between 1975 and 2000. This increase is the product of a rapidly increasing female employment rate, which has outweighed a decline in the rate of male employment over the past three decades.

Data from the March Current Population Surveys (CPS) show a fall in the employment–population ratio for males 18–64 years old from over 0.9 in 1967 to 0.82 by the mid 1970s, and it has held nearly steady since then.[8] Among low-skilled subgroups of the male population, however, the ratio continued to fall into the late 1970s and early 1980s. These declines were most pronounced among blacks, high school dropouts, and both the oldest and the youngest age groups within the working-age population.[9] All of these groups are heavily

represented in the lower tail of the skill distribution of the nation's potential workforce.[10]

Between 1975 and 2000 the employment–population ratio of working-age females (aged 18–64) increased from 49 percent to 69 percent, a jump of over 40 percent. The employment rate increased for nearly all white and black female age and schooling groups except for high school dropouts, aged 20–24 years, which showed little change from its low level (about 0.5) from 1970 to the mid 1990s. The employment rate for young, low-education women has increased since then (see U.S. House of Representatives, Committee on Ways and Means 1993; Blau and Kahn 1997; Holzer and Offner 2001).

Juhn, Murphy, and Topel (1991) and Juhn (1992) conducted two of the more rigorous studies of the decline in male employment rates.[11] The studies focus on the early 1970s to the early 1990s, use similar techniques, and concentrate on nonstudent, civilian males with 1–40 (or 1–30) years of potential labor-market experience. The evidence suggests that, from the early 1970s until the early 1990s, the downward shifts of labor demand along stable supply curves accounts for most of the decline in the employment of white men and half of that for blacks.[12] The parallel movement of real wages and employment for low-skill workers over this period supports this view of the important role of demand shifts.[13] However, the reasons why the demand for such labor has declined are not well identified. Researchers place varying emphasis on factors such as increased openness to imports, skill-biased technological innovation, and/or competition from increases in the immigrant and female labor force.[14]

Since the early 1990s, this decreasing trend in the employment rate of low-skilled males seems to have been tempered, if not reversed. Again, however, there is disagreement among researchers as to the dimensions and composition of these trends. For example, while Freeman and Rodgers (2000) indicated that the employment rate of low-education young men, especially young black men, has increased during the 1990s, Lerman, Riegg, and Aron (2000) and Holzer and Offner (2001) suggested trends that more closely resemble those of the 1970s and 1980s.

## Labor Force Participation

Juhn, Murphy, and Topel (1991) attributed about one-half of the secular decline in employment of prime-age males between 1967–1969 and 1987–1989 to a decline in labor force participation, the other half to increased unemployment.[15] The fall in participation has been most dramatic among older working-age males; for example, the participation rate for men aged 50–65 fell from 86 percent in 1969 to 77 percent in 1979 and to 72 percent in 1989. The robust economy and strong labor demand of the 1990s seems to have offset this decline.

This downward trend of the 1970s and 1980s has been the subject of a substantial literature. In particular, the contribution of disability-related transfers (in particular, the Social Security Disability Insurance program) to labor-market withdrawal has been extensively studied. While a wide range of estimates exist, the prevailing consensus is that this program has led to a decrease in the labor force participation of older males, but that it has not been the main factor causing that decline (Haveman and Wolfe 2000; Autor and Duggan 2001).

In contrast, female labor force participation has been increasing for all age groups for most of the twentieth century (Smith and Ward 1985; Coleman and Pencavel 1993b). Over the past three decades, the increase has been particularly rapid for young women. From 1969 to 1979, the participation rate of 25–49-year-old females increased from 48 to 63 percent, and it had risen to 74 percent by 1989. The bulk of the increase in female participation between 1950 and 1990 has been attributed to a combination of rising real wages of women and reductions in childbearing related to increased labor-market opportunities. Explanations for the remainder of the trend include higher education levels, greater marital instability, changing societal attitudes, and non-wage induced reductions in childbearing. During the 1990s, the upward trend in female labor force participation continued but at a substantially slower pace than in the prior two decades, in spite of the rapid increase in overall labor demand.[16]

## Unemployment

Measuring unemployment is difficult given the ambiguity of the "looking for work" condition. This, as well as the discouraged worker

phenomenon (see below),[17] clouds the distinction between unemployment and nonparticipation and provides an argument for focusing on employment as an indicator of labor-market activity (Clark and Summers 1979; Juhn 1992; Flinn and Heckman 1983). Nevertheless, the unemployment rate is informative of the proportion of individuals currently seeking but not in employment.

A number of studies have identified a secular increase in unemployment during the decades of the 1970s and 1980s;[18] most of the increase during this period has been attributed to increased durations of unemployment spells. Indeed, most of the unemployment experienced during this period is attributable to individuals experiencing long spells of not working.[19]

Again, the concern with the increasing secular increase in unemployment pertains primarily to the period prior to the prosperity and rising labor demand of the 1990s, when full employment conditions for virtually all worker groups put concerns regarding this pattern on the back burner.[20] Unemployment rates fell for virtually all gender, schooling, and age groups during the years after 1992.

**Part-Time Work**[21]

The proportion of civilian nonagricultural workers in part-time jobs has increased slowly, but steadily, over the past several decades, from 12 percent in 1968 to nearly 20 percent in 1999.[22] This increase is primarily due to the rise in females as a proportion of the labor force; about one-quarter of female workers were in part-time employment at the end of the 1990s. Additionally, part-time employment has increased among males; from 5.3 percent of workers in 1968 to 12.6 percent in 1999. Moreover, for both sexes, there has been an increase in the proportion of part-time workers who would prefer full-time employment; by the early 1990s, part-time work was not the desired option for about one-quarter of female and one-half of male part-time workers. The rapid growth in employment demand during the 1990s has likely reduced this involuntary part-time work, although little evidence on recent changes in this pattern exists.[23]

## Hours Worked by Employees

Data from the 1940–1980 Decennial Censuses and the annual March CPS files indicate little change in median weekly and annual hours of male and female employees aged 16–64 years over the last several decades (Coleman and Percavel 1993a,b). However, this aggregate picture masks changes that have occurred within age, race, and gender groups. For both sexes, the mass at the upper tail of the hours distribution fell for less-educated groups and rose for those with more schooling, particularly for whites. These shifts in the distribution of weekly and annual hours, after controlling for education, are more pronounced for females than males. There have been substantial declines in the weekly hours of young and older male employees, particularly among blacks. The hours of prime-aged white male workers have changed little or increased slightly. This difference across age groups in the hours trends is not evident for females. Coleman and Pencavel (1993b) concluded from their analyses that gender differences in work behavior are becoming less important relative to differences by skill groups.[24]

These findings on work hours are inconsistent with the claim by Schor (1991), from analysis of 1969–1987 CPS data, that mean hours have increased over the past 20 years for workers of many demographic groups. The explanation for the inconsistency appears to be that Schor may have examined trends in the hours worked by FTFY workers only. The evidence cited in the previous section of increases in part-time work, together with the fact that there has been little change in median hours of work, also suggests an increase in hours worked by full-time employees.[25]

## Real Wages

Over the past four decades, there has been a substantial shift in the structure of wages in the U.S. labor market.[26] Relative to the 1960s, overall real wages have grown relatively slowly since the mid 1970s.[27] However, over this same period, the real wages of all low-skilled worker groups have declined, at least until 1997. These trends were more negative for low-skilled men than for women over this period. As a consequence, overall wage inequality has increased substantially,

while the gender gap in real wages among low-skilled workers has narrowed.[28] While some evidence has indicated that increased dispersion of wages is responsible for increased earnings, more recent evidence suggests that an increase in the dispersion of work time has also played an important role (Haveman and Buron 1998).

Labor-market returns on education increased through the 1960s, declined over the 1970s, and increased again since the beginning of the 1980s. Trends in the college premium over the first two of these periods have been attributed to shifts in the supply of differentially skilled labor, with relatively stable demand. Shifts in labor demand have been the dominant factor in explaining the change in the wage structure since the early 1980s and through the 1990s. The changes in technology associated with the recent expansion have resulted in an increase in demand for highly educated/skilled labor that has not been met sufficiently by expanding supply (Katz and Murphy 1992). Additionally, the demand for low-skilled labor has shifted downward, for reasons related to import penetration, changes in production technology, increases in the supply of female and immigrant workers, and the decline in the real minimum wage and unionization (Fortin and Lemieux 1997; Johnson 1997) as discussed above.

**Discussion**

Examination of trends in a variety of indicators of labor-market activity from 1970 to the mid 1990s leads to what appears to be a robust conclusion; namely, until very recently, labor-market activity and real wages have declined for less-educated labor, especially men. Overall, this decline in activity has been somewhat counterbalanced by the continuing increase in female employment. Existing research suggests the decline in activity of low-skilled labor is due to a shift in the relative demand for this type of labor input. Import penetration and technological innovation appear the most likely reasons, with some contribution from decreases in the real minimum wage and the decline in unionization. The possibility that the increased supply of female labor has crowded out male labor is supported by some research studies but not by others. Other issues arising from these labor-market trends concern their social and economic consequences, such as the implications for family income inequality and poverty. Less consider-

ation has been paid to the impact of these trends on the productive potential of the economy and the utilization of this potential.

Again, it must be emphasized that many of these trends appear to have reversed themselves, at least temporarily, during the period of unprecedented growth in labor demand and employment experienced in the latter half of the 1990s. Our estimates of human capital utilization for various education, age, and gender groups through the end of the 1990s will shed light on the extent of this reversal.

## ORGANIZATION OF THE VOLUME

We begin our study by reviewing in Chapter 2 an extensive set of existing statistical series that document the nation's economic potential and its physical and human capital stocks. These measures include series describing the nation's productive capability—potential GDP, the level of its physical and human capital—and indicators of the extent to which the nation's productive capability is utilized. The series that we discuss are all produced by the statistical agencies of the federal government, and some of them are regularly published. Because our estimates of the level and trend of EC and of the utilization of EC are closely tied to economic concepts of physical capital and its utilization, they serve as complements to and extensions of these measures.

In Chapter 3, we confront basic questions regarding the economic concept of human capital and its measurement. As we will see, defining the value of a nation's human capital is not a straightforward matter. Should we measure the value of human capital as a gross or net value? Should this value reflect the individual evaluation by the person who holds the human capital or should it reflect a broader social evaluation? Should we measure its asset value or the annual value of the services that this capital could (or does) yield in a particular period of time?

Chapter 4 reviews a selection of prior contributions to the extensive economics literature on the concept and measurement of human capital. Much of this literature is designed to serve as the basis for understanding the process of human capital formation, including measures of the economic returns on schooling and training. We discuss

the basic analytical contributions to the human capital concept, and we indicate their implications for measuring both the stock of human capital and the annual flow of services from it. We also summarize the literature on empirical measures of the nation's human capital stock.

Chapter 5 presents the nuts and bolts of our EC estimation. We will see that EC is the annual earned income (labor-market payments) that each working-age person would receive if he or she used his or her skills, training, and other productive characteristics to his or her potential. We use workers in each year who do, in fact, work FTFY as the basis for estimating the value of EC for all working-age people.

We provide a rigorous empirical definition of the EC concept that we use in measuring the level of human capital. Then, using this definition, we describe the statistical conventions and procedures that we adopt in our empirical work. We apply these procedures to large representative samples of the U.S. population for the years 1975–2000. We describe this data source and its use in our estimates. We also explain the reasons why we have selected the working-age population as the basis for our estimates and describe the earned income concepts on which our measures rest.

In Chapter 6, we use the concepts, data, and estimation procedures described in Chapters 3–5, and show the results of our estimation of the level and trend of aggregate EC in the United States since 1975. Total EC is allocated to gender, race, age, education, and family-status groups, and the changes in each group's contribution to aggregate EC over time is discussed. For example, because of the well-documented increase in the returns on schooling and in the share of the working-age population with postsecondary education, we would expect to observe rapid growth in the share of human capital attributable to that group.

However, the nation's aggregate EC is made up of both the number of working-age people in the population and the marketable skills and knowledge that they possess. To distinguish the growth of aggregate EC that is caused by a growing working-age population from that caused by increases in productive skills of the members of this population, we also show patterns of EC on a per capita basis.

Given our concept of EC—the annual market rental value of the nation's human capital stock—we adopt a natural way of estimating the extent to which that stock is utilized. For any individual, the ratio of actual earnings to EC is a CUR. It measures the value of the labor-mar-

ket services actually produced by the person relative to the potential value of the services that could be produced if the person's human capital were used to capacity. We then use this CUR concept to measure the overall extent to which human capital is utilized.

Also in Chapter 6, we measure the portion of potential human capital services that are not utilized in market activities. By subtracting the portion of EC that is utilized in market work from the total EC for any person, we obtain a measure of unrealized potential earnings for each year. We estimate this value for each year and present these patterns both in aggregate and per capita terms.

An important question concerns the reasons for unrealized potential earnings for the entire working-age population, and Chapter 6 addresses this question as well. On the basis of what people state as the reason for not working FTFY, we allocate unrealized potential earnings among a set of six categories, each of which indicates a reason for not using potential human capital services in market activities. We are able to distinguish the following reasons for each individual and, hence, for the working-age population: retirement, housework (including at home child care) voluntary part-time work, involuntary unemployment, illness/disability, and other.

We also group these components into "exogenous constraint" (e.g., involuntary unemployment) or "voluntary response" (e.g., retirement) sources of unutilized human capital. By presenting these patterns over time, we are able to explore the extent to which working-age people have altered their utilization of human capital because of voluntary choices or because of involuntary constraints that are imposed on them. Clearly changes in capacity utilization that result from voluntary decisions have quite different economic and social implications than changes that are due to involuntary constraints. We show these patterns over time as well.

In Chapters 7 and 8, we present these patterns of human capital levels and trends, utilization, and the sources of unutilized human capital by subgroups of the population. Again, these patterns are shown in both figures and tables. In Chapter 7, we disaggregate these patterns by gender, race, schooling levels, and age. In Chapter 8 these patterns are explored for particularly vulnerable subgroups of the working-age population, in particular young and older worker groups with low levels of education.

Finally, in Chapter 9, we review the case for our EC indicator of human capital, explore the assumptions on which this measure is based, and present the insights of our estimates for understanding the human capital effects of welfare reform, the progress made in increasing human capital utilization of minority youths, and the recent patterns of utilization for the older working-age population. We also pull together some of the main patterns that our analysis has revealed and draw a few conclusions from these findings for public policy.

## Notes

1. The present value of a stream of future returns is calculated using a discount rate to reflect the fact that returns obtained in distant years are valued today at less than returns received currently. This calculation is called "discounting."
2. As such, EC can be viewed as the annual potential rental value of the human capital stock embodied in the nation's working-age population.
3. Economists define an efficient level of plant utilization as the output level at which the minimum point on the plant's short-run average cost curve equals long-run average cost.
4. We will discuss the conventions that have been adopted in Chapter 2.
5. In Chapter 5, we discuss the assumptions on which the EC indicator of human capital rests, as well as the limitations of both the concept and our measure of it.
6. Blank and Shapiro (2001) presented detailed estimates of the contributions of changes in employment and labor force participation, weeks worked, and earnings per week to annual earnings for detailed demographic groups during the decades of the 1980s and the 1990s. These estimates complement our discussion.
7. The employment–population ratio is total civilian employment divided by the civilian noninstitutionalized population over 16 years of age.
8. Juhn (1992) reported a decrease in the employment–population ratio of males aged 18–63 from 0.93 in 1975 to 0.87 in 1987. The figures in the text update her estimates.
9. See U.S. House of Representatives, Committee on Ways and Means (1993). Gottschalk (1997) reported that employment rates for male high school dropouts with more than 10 years of experience declined from 78.5 percent in 1975 to 67.4 percent in 1994, while employment rates for experienced males with some post-secondary schooling increased. At the beginning of the 1990s, more than 30 percent of black high school dropouts, aged 20–35 years had not worked at all in the previous year (U.S. House of Representatives, Committee on Ways and Means, 1993). More recently, Holzer and Offner (2001) showed that, from 1979 to 1999, the employment rate of young, less-educated, out-of-school, black males fell from 63 percent to 50 percent. Between 1992 and 2000, the employment rate of this group improved by only a few percentage points, while their labor force participation rate actually dropped by five points.

10. Juhn (1992) attributed the bulk of this increase in male joblessness to an increase in the duration, rather than the incidence, of nonwork periods.
11. The following discussion draws heavily upon their findings. See also Bound and Johnson (1992) and Johnson (1997).
12. The relative decline in employment among blacks over the latter period is attributed to a relative shift in the labor-supply function of blacks.
13. Several studies have focused on the cyclical changes in employment for various groups, as opposed to longer term trends. These studies convincingly show that the employment and earnings of less-educated workers are more heavily affected by macroeconomic performance than are those of other groups. See Hoynes (2000) and Hines, Hoynes, and Krueger (2002).
14. Early studies that have attempted to disentangle these determinants include Juhn (1992) and Murphy and Welch (1992). Studies by Freeman (1995), Richardson (1995), and Wood (1995) focused on the potential role of increased import penetration and, except for the last, ascribed a relatively minor role to this factor. Berman, Bound, and Griliches (1994) provided evidence that the nature of technological change has been an important determinant of this relative demand effect. Topel (1997), citing a variety of studies, concluded that neither immigration nor the increase in female labor force participation has played a large role in explaining this pattern, although some studies have indicated the opposite. There is some evidence that changes in the minimum wage and the extent of unionism have also contributed to the decline in male employment over this period (see Fortin and Lemieux 1997).
15. Since this result is for males with 1–30 years of labor market experience, which corresponds to an approximate age range of 18–48 years for high school graduates, it will understate the relative importance of the decline in labor force participation for all males.
16. Blank and Shapiro (2001) suggested an end to the increase in female labor force participation, except possibly among low-skilled women.
17. Division of employment trends into changes in labor participation and unemployment is made difficult by the existence of discouraged workers. Examination of cyclical movements reveals little discouraged worker effect amongst prime-aged males (Juhn, Murphy, and Topel 1991), but the participation of females and teenagers is sensitive to cyclical movements in the unemployment rate (Clark and Summers, 1982). There is, however, evidence that the secular increase in unemployment amongst prime-aged males over the past few decades has resulted in a substantial discouraged worker effect within this group (Juhn, Murphy, and Topel 1991).
18. See Clark and Summers (1979); Summers (1986); Poterba and Summers (1986); Murphy and Topel (1997); Juhn, Murphy, and Topel (1991); and Juhn (1992). The discussion in the text relies on their findings. In many respects, 1970–1990 trends in unemployment rates resemble trends in employment ratios. The most dramatic increase in the unemployment rate has been amongst prime-aged males, particularly in the younger age groups (< 25 years), with relatively little increase

in female unemployment. Unemployment rates are high and increasing most rapidly for the lower education groups. The amount of unemployment due to individuals losing, rather than leaving, jobs has increased over these years.

19. Explaining the secular increase in unemployment during the 1970s and 1980s has proved difficult. For the increase to be consistent with a rise in the natural rate of unemployment, rates of mobility of individuals across occupations and industries should be observed, but data do not support this hypothesis. Search theories have little relevance given the majority of unemployment is attributable to long spells. Classical and neo-Keynesian theories also provide limited insight into secular changes in the unemployment rate, as opposed to transitory changes related to wage or price inflexibilities. The unemployment rate has increased at given levels of other economic activity indicators, suggesting it is not simply an aggregate demand problem. The predominance of job losers rather than quitters among the unemployed, together with the fact that real wages have moved in the opposite direction to unemployment for the most affected groups, casts doubt on the importance of intertemporal substitution theories. The disincentive effect of unemployment insurance is not a strong candidate to explain the trend in that the unemployment rate has fallen among the insured population. Summers (1986) attempted to establish whether the secular increase in the aggregate unemployment rate during the 1970s and 1980s was simply an artifact of changes in demographic composition. Separate standardizations for age/sex, marital status, education, and industry compositions revealed no effects strong enough to explain the aggregate trend. Indeed changes in the education and industry compositions had the largest effects, and these suggest a reduced unemployment rate. This result receives some support from Juhn, Murphy, and Topel (1991) who indirectly standardized the unemployment (and nonparticipation) rate for experience, race, education, and marital status and found no demographic effect. As noted above, Juhn, Murphy, and Topel (1991) and Juhn (1992) placed primary responsibility for the decline in male employment since the early 1970s on a downward shift in relative demand for low-skilled labor. The same argument has some force in explaining the secular increase in unemployment. An alternative argument attributes the problem to segmentation in the labor market, with high-wage and low-wage jobs for given skill levels, with trade unions and other institutions enforcing the segmentation (see Summers 1986). With structural shifts reducing the demand for labor of a given skill in the high-wage sector, displaced workers take longer to take another job in the hope of getting back into the high-wage sector. The two explanations are consistent, providing it is low-skilled workers who have experienced the decline in opportunities in the high-wage sector.
20. Indeed, Hines, Hoynes, and Krueger (2002) concluded that, over the entire 1970–2000 period, "unemployment rates have been trending downward" (p.11).
21. Discussion in this section relies on Blank (1990), as updated with more recent estimates.
22. Data are from the CPS. Part time is defined as working fewer than 35 hours per week.

23. Blank and Shapiro (2001) indicated no increase in weeks worked per employed person during the 1990s, compared to 2 percent growth during the 1980s.
24. The difference by skill in hours trends are unaffected by movements in real wages and are not explained by changes in demographic composition. Hours trends are not explained by the business cycle or changes in cohort sizes.
25. A comprehensive framework for analyzing the utilization of labor—the Labor Utilization Framework—was put forward by Hauser (1974). In his words, this framework represents an "attempt to develop a comprehensive, multi-dimensional measure of underemployment." In this framework, the labor force (or the "modified" labor force) is allocated to six categories of labor-market activity: discouraged workers, unemployed, involuntary part-time workers, full-time workers with earnings less than 1.25 of the poverty line, mismatched workers (employees with years of schooling one standard deviation above the mean for their occupation), and a residual category of the adequately (or fully) employed. Using this framework and March CPS data, Clogg and Sullivan (1983) examined trends in the proportion of the labor force in these categories over the 1969–1980 period. The proportion of the modified labor force adequately employed declined from 77 percent in 1969 to 67 percent in 1980. The decline was more pronounced for males. Discouraged workers as a proportion of the modified labor force showed no secular trend in the aggregate, but there was an increase among blacks. (Juhn, Murphy, and Topel [1991] reported an increase in discouraged workers among prime-age males. The inconsistency may be explained by the fact that the latter study examined trends up to the late 1980s within gender-, age-, and race-specific cells.) The unemployment category shows a secular increase during this period, both overall and for all subgroups. This is also true of involuntary part-time employment. Both findings are consistent with the secular trends observed in the separate analyses of these indicators reported above. For females and blacks, the proportion of full-time workers with earnings less than 1.25 of the poverty line fell over this period. Clogg and Sullivan found that 30 percent of the overall variability across time in the distribution of the modified labor force across the activity categories is attributable to changes in demographic (gender/age/race) composition. They attributed more than three-quarters of this demographic effect to changes in the age distribution—in particular, the increase in the relative proportion of the labor force in the 20–35 year age group—with the remainder being due to shifts in the gender balance. (Note that this decomposition does not control for changes in the schooling of the labor force.) While updated estimates using this framework do not exist for the period after the recession of the early 1990s, it seems unlikely that the trends observed until that time have persisted in the full employment environment of the mid to late 1990s.
26. The early literature includes Burtless (1990), Moffitt (1990), Bound and Johnson (1992), Murphy and Welch (1992), and Levy and Murnane (1992). The more recent evidence is summarized in Gottschalk (1997), Johnson (1997), and Topel (1997). The discussion in the text relies on these studies.

27. Blank and Shapiro (2001) compared peak-to-peak real wage growth over three expansions since 1961. They found that from 1961 to 1969, real wages grew nearly 28 percent. They grew by less than 9 percent from 1980 to 1990, and grew only about 14 percent even during the expansion of the 1990s.
28. See Blau and Kahn (1997). Holzer and Offner (2001) reported severely declining real wages for young less-educated men and women of all racial groups from 1979 to about 1996 or 1997; since then, however, substantial real wage growth has been experienced by all racial groups, especially for women.

# 2
# Indicators of the Nation's Production Capacity and Utilization

As we indicated in Chapter 1, existing statistical indicators of the nation's productive capacity, and of the utilization of that capacity, are far from comprehensive. These weaknesses and gaps are especially prominent in existing series designed to measure human capital and its utilization. A central objective of this monograph is the development of a new indicator of the nation's human capital to complement existing series in revealing the level, trend, and utilization of the nation's labor resources.

The measure that we develop, EC, reflects both the work-time capacity of the population of working-age people and the market-valued productivity of the work time of each member of that population—both the quantity of potential labor services and the price attached to them. When this value is aggregated over all working-age citizens, it reflects the value of the potential contribution to the nation's output available from this workforce. In contrast, existing measures of human capital capacity—the number of potential work hours available in the economy, the size of the working-age population, or the size of the labor force—reflect only the quantity of potential labor services available (counts of people or hours), irrespective of the productivity (or value) of these potential labor services. By combining both the quantity and price components of potential work hours, EC provides a more comprehensive measure of nation's human capital than do other indicators.

In this chapter, we describe a number of regularly published statistical indicators of the nation's productive capacity and the utilization of that capacity. Our EC measure is designed to complement these commonly used indicators, thereby extending our understanding of the performance of the labor market and the economy. We present evidence on these capacity and utilization measures over the period from 1975 to

2000, which also serves as the period of our analysis of the EC-based measures. As we will see, the levels and time-trend patterns of productive capacity and utilization indicators vary substantially across these existing indicators.

We first present the most comprehensive measure of the overall production capacity of the nation, namely potential GDP, and compare it to actual GDP. We then review and summarize an indicator of a primary input to production, namely the nation's stock of physical capital. This measure shows the level of this crucial input that is available to support the nation's production of goods and services. We then turn from physical capital to the nation's human capital and describe a variety of commonly used and cited indicators of human capital stock. Finally, we explore available indicators of the use of productive capacity, all in the form of capacity utilization ratios.

## AGGREGATE NATIONAL PRODUCTIVE CAPACITY

### Potential GDP

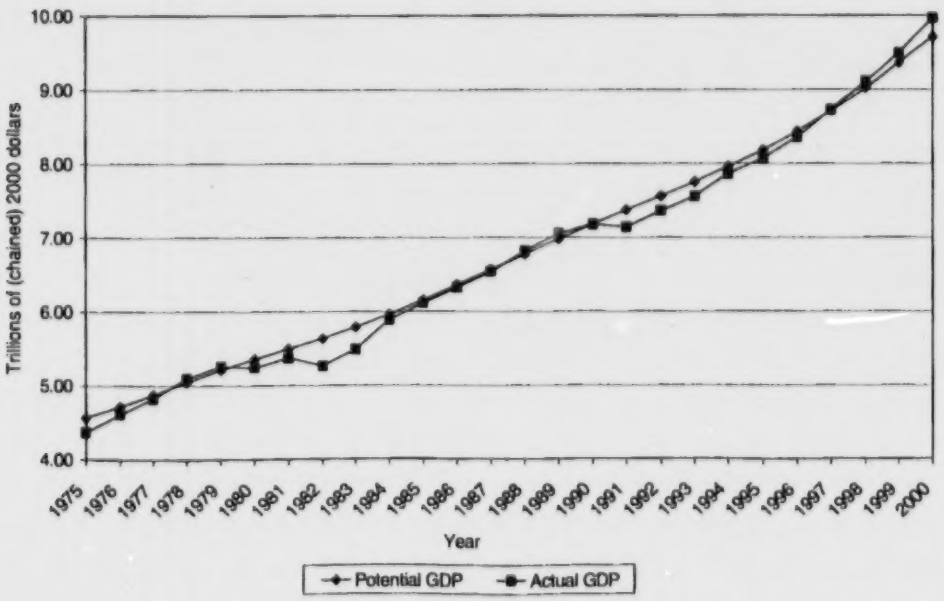
The most comprehensive indicator of the economy's productive capability is potential GDP. Potential GDP is the level of final goods output attainable when both the nation's capital stock and potential labor supply are fully utilized. In this approach, full utilization is taken to be the level of production that would result from the voluntary, normal utilization of the nation's capital and labor resources when the economy is performing smoothly and at full production levels. This indicator is often referred to as the full-employment level of output; while potential GDP has been calculated by federal government agencies for several decades, it is only sporadically published.

Early calculations of this indicator involved stipulating a rate of unemployment below which inflationary and other strains would appear in the economy (judged to be the level of "full employment"), and then estimating the volume of gross final product that could be produced at that unemployment rate.[1] In the early 1960s, Arthur Okun developed a second approach to measuring potential GDP.[2] His approach also rests upon utilization of the pool of potential labor in the

economy. Measures of the size of the population, workers as a share of the population, hours per worker, and output per hour of labor time are used to calculate the level of potential final output from the nation's potential labor pool.[3] Today, the Congressional Budget Office (CBO) calculates the most widely recognized measure of potential GDP and employs it in the annual CBO economic forecast.[4]

Figure 2.1 presents the CBO's potential and actual GDP series (in 2000 dollars) for the years from 1975 to 2000.[5] The nation's potential output level grows rather steadily, reflecting the underlying changes in investment, depreciation, the accumulation of productive skills by the workforce, and changes in the size and composition of the workforce. From 1975 to 2000, real potential GDP—an indicator of the nation's final output if the nation's physical and human capital were used at their normal capacity—more than doubled, increasing from about $4.6 trillion to $9.7 trillion. This implies an average annual rate of growth of 3.1 percent over the period. As suggested in Figure 2.1, the level of the nation's actual final output grew at an annual rate of 3.4 percent, outpacing the growth of potential GDP over this period.[6]

**Figure 2.1 Potential and Actual GDP, 1975–2000**



During the late 1970s, late 1980s, and especially the period since 1997, actual GDP exceeds potential GDP. When actual GDP exceeds potential GDP, the economy is producing more than historic patterns suggest is possible without pressure for an increase in prices, a situation that is viewed as unsustainable for a prolonged period.

In the recession years of the early 1980s and early 1990s, the decline in investment spending had a noticeable impact on potential GDP. Potential GDP grew at an annual rate of only 2.6 percent between 1980 and 1982 and by a rate of 2.7 percent between 1990 and 1992. Actual GDP moves erratically over time reflecting changes in the macroeconomic performance of the economy and the ability of the nation to use fully its productive resources. Actual GDP grew annually by only 0.1 percent between 1980 and 1982 and by 1.4 percent between 1990 and 1992.

## PRIVATE BUSINESS CAPITAL STOCK

The patterns of the potential GDP series reflect trends in the nation's stocks of human and physical capital, the two primary inputs into final output. Public statistics are also available on the individual components of this productive capacity. In this section, we present several estimates of the level and growth of the nation's stock of physical productive capital.

Various indicators of the nation's stock of physical capital have been developed and measures of them regularly published, by agencies of the U.S. government. They vary widely in the methods used for their construction and, hence, in their levels and trends. In publicly available form, these series are often expressed in units that do not enable comparison among them or comparison to the level and trend in the potential GDP indicator. While some are expressed in dollars (either constant or current), others are presented as indices, with some base year chosen as an arbitrary starting point and designated as 100.

In this section, we briefly describe the conceptual basis of one of these capital stock series and discuss its estimation. We also indicate

how we have adjusted the available series in order to present patterns that are comparable across the series.

**BEA Aggregate Physical Capital Stock**

The Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce has developed annual estimates of the Real Net Stocks of Fixed Assets and Consumer Durables from 1925 to the present. While the estimation procedure that underlies these indicators has been regularly modified, a major revision of the procedure was undertaken in the mid 1990s.[7]

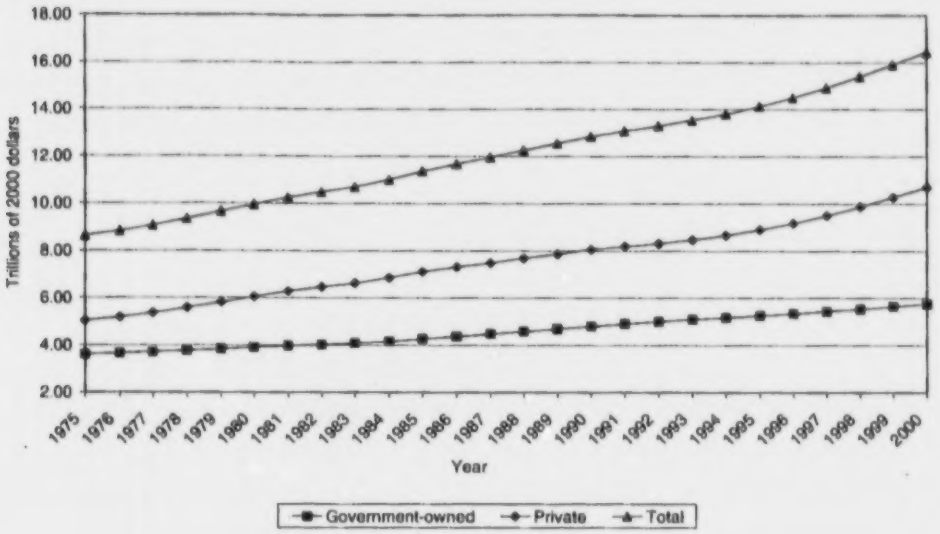
The published estimate of the stock of physical capital is composed of two main components: fixed private assets, which includes the net stock of privately owned equipment, structures, consumer-owned durable goods, and owner-occupied housing; and a second series for fixed government assets, which includes the net stock of government-owned equipment, structures, and durable goods. Because this definition of the aggregate net stock of fixed, reproducible tangible wealth[8] includes assets such as consumer durables and owner-occupied housing that are not used for further production, it fails to accurately measure the nation's capital stock available for production.[9]

In order to reflect the potential contribution of the capital stock to aggregate productive capacity in the nation, we use the series for private, net *nonresidential capital* (which excludes consumer durables) plus *government-owned capital*, in 2000 dollars, for years 1975 to 2000.[10]

Figure 2.2 shows the total volume of net private nonresidential fixed assets, covering both equipment and nonresidential structures (middle line). These capital items constitute the assets—private equipment and private nonresidential structures—typically thought of as comprising the nation's stock of business capital. The figure also shows the level of net government-owned fixed capital, as it too contributes to the nation's aggregate productive capacity (bottom line).[11] These series, stated in 2000 dollars and reflecting replacement cost, provide a measure of the nation's capital stock available to support production in the United States.

Figure 2.2 shows that the stock of privately owned capital in the United States is substantially larger than the stock of government-

**Figure 2.2 Real Net Stock of Private Nonresidential and Government-Owned Fixed Assets and Consumer Durables, 1975–2000**




owned capital. Moreover, over the 1975 to 2000 period, the private capital stock has grown more rapidly than the government stock. The average annual percentage rate of growth of the stock of private nonresidential capital was 3.1 percent over this period, while the stock of government owned productive capital grew at a 1.9 percent rate. Much of the growth of the stock of privately owned capital occurred during the latter half of the 1990s, when the privately owned net stock grew by 3.6 percent per year while government-owned capital grew by only 1.8 percent per year. This is perhaps not surprising given the favorable environment for business investment during the 1990s. The top line in Figure 2.2 is the sum of the two series and is provided as an expanded concept of the nation's capital stock—it has grown by an annual rate of 2.6 percent over the period.

## HUMAN CAPITAL STOCK

Indicators of the productive capacity of the nation's human capital stock are far less sophisticated than those of the stock of physical capi-

tal. Substantial effort goes into measuring the value of individual forms of physical capital and aggregating over these forms to obtain an estimate of the value of the physical capital stock. Industrial capacity indices such as those produced by the Federal Reserve Board (not shown here)[12] rest on similarly detailed type-of-asset calculations. In contrast, the most common indicators of the level of human capital tend to be simple counts of people in various age categories, labor force participants of various ages, or the potential hours that working-age people or labor force participants can work.

**Potential Work Hours**

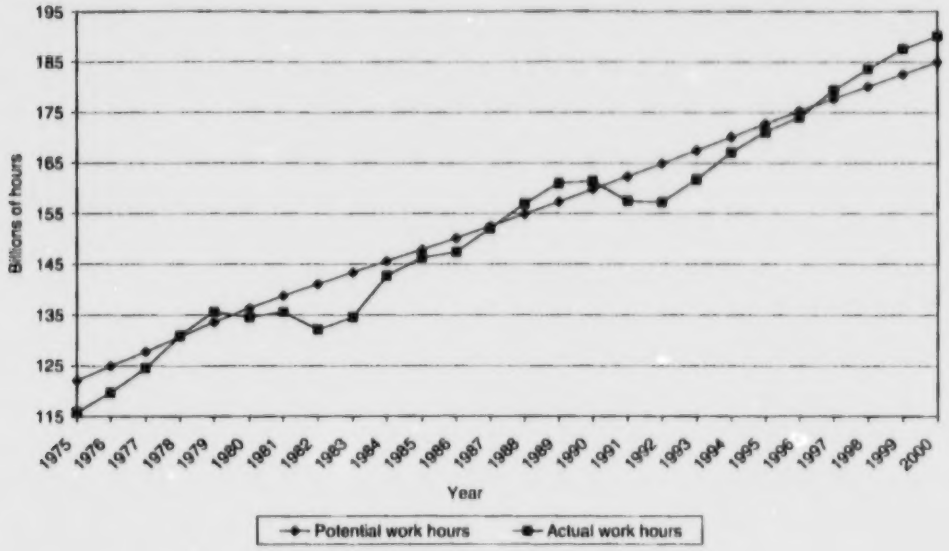
The CBO calculates an annual series of potential work hours for use in estimating historical potential GDP (and forecasting long-term real GDP and other macroeconomic variables). As such, the estimate of potential work hours is an input into production function estimation of historical potential output (described above).

The potential work hours estimate calculated by the CBO is an estimate of the number of hours that would be worked in the nonfarm business sector if the nation enjoyed a rate of unemployment consistent with a stable rate of inflation (also known as the NAIRU or the nonaccelerating inflation rate of unemployment).[13]

Figure 2.3 shows the level of annual potential and actual work hours in the U.S. economy from 1975 to 2000, obtained from the CBO. The level of potential work hours is a smooth series reflecting growth in the labor force, employment, and the average work week (and, of course, the NAIRU). Potential work hours in the United States have grown steadily over the period, from 122 billion hours in 1975 to 185 billion hours in 2000, an increase of 52 percent. Over the entire period, the average annual growth rate was 1.7 percent.

Actual work hours have grown from 115.8 billion hours in 1975 to 190.1 billion hours in 2000. While actual work hours trend upwards over the entire 1975–2000 period, decreases are observed in the 1980–1982 period (–0.9 percent) and the 1990–1992 period (–0.8 percent). Finally, mirroring the economy's growth of the latter part of the 1990s, actual work hours increased from 179.3 to 191.1, or by 6.6 percent, between 1997 and 2000. As expected, actual work hours track the performance of the economy more closely than potential work hours.

**Figure 2.3 Actual and Potential Work Hours, 1975–2000**




Note that both the potential and actual work hours series are counts of person-hours, one reflecting the potential stock of human capital services and the other reflecting that actual volume of human capital services used. As indicators of the human capital stock, they fail to distinguish the differential productivity among potential workers with widely divergent characteristics such as age, schooling, and past work experience. As noted above, the estimate of EC developed in this volume combines both the price and quantity elements of the human capital stock.

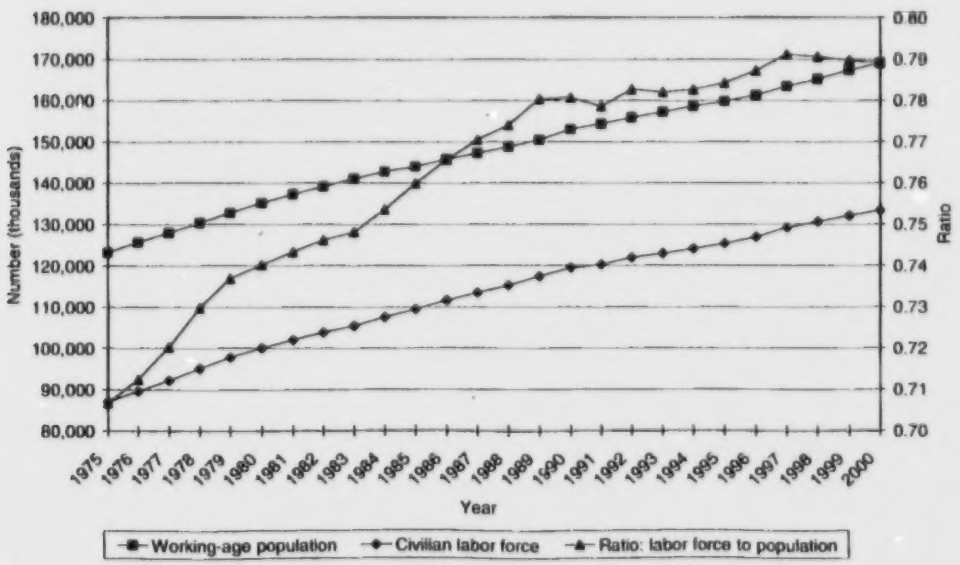
## Total Working-Age Population and Labor Force

The most commonly used indicators of the nation's human capital stock are the size of the working-age (ages 18–64) population and working-age labor force.[14] While both the population and labor force indicators reflect the available stock of human capital, only the population series is independent of individual choice. Although widely used as an indicator of the human capital potential of the economy, the labor force (the number of people either working or seeking work) reflects choices made by individuals of working age regarding whether or not to seek work.

Figure 2.4 shows the trends in these measures over the period from 1975 to 2000 (scale on the left). The size of the working-age population grew from 123 million in 1975 to 169 million in 2000, an increase of 37 percent. The size of the nation's working-age labor force grew from 87 million in 1975 to 133 million in 2000, an increase of 53 percent, indicating the higher proportion of the working-age population working or seeking work at the end of the period. While the annual growth rate of the working-age population over this period was 1.3 percent per year, the rate of growth of the working-age civilian labor force was over 1.7 percent per year.

Figure 2.4 also shows the ratio of the labor force to the population (scale on the right), indicating the share of the working-age population that is willing to make themselves available for work. The labor force-to-population ratio rose steadily between 1975 and 1989 from 0.71 to 0.78 (a 0.71 percent average annual rate of growth). From 1990 to 2000, the ratio was virtually constant, growing at an annual rate of only 0.10 percent during this decade. This trend reflects the difference between the working-age population and the labor force, which captures the size of the "inactive" working-age population. The size of the working-age population that does not make itself available for market

**Figure 2.4 Working-Age Population, Civilian Labor Force, and Ratio of Labor Force to Population, 1975–2000**



work fell from 36 million in 1975 to 33 million in 1989, after which it rose to 35.6 million in 2000.

## INDICATORS OF THE UTILIZATION OF CAPACITY

The statistical agencies of the federal government regularly publish several indicators of the utilization of the productive capacity of the U.S. economy. These indicators are typically based on comparisons of the indicators of potential (or capacity) output or employment (described above) with actual levels of the same variable.

### Potential GDP Utilization Rate

Perhaps the most comprehensive utilization rate indicator relates the actual level of GDP to the level of potential GDP, discussed above. Taking account of the main supply-side components of economic growth—population, labor force participation, the work week, and labor productivity—potential GDP reflects the level of final goods output that could be attained if the labor force were fully employed.[15] The ratio of actual GDP to its potential level can be interpreted as a capacity utilization rate (CUR).

Figure 2.5 shows the level and pattern of capacity utilization revealed by this indicator over the period from 1975 to 2000. As expected, the CUR varies with the business cycle, reaching a low of about 93 percent in the recession of the early 1980s and highs of 101 percent in the prosperity years of 1978 and 1989. After falling to about 97 percent in 1991, the CUR has risen steadily to an unprecedented level of 103 percent in 2000.[16]

### Industrial CUR

The industrial CUR is regularly calculated and published by the Federal Reserve Board. The numerator of this utilization rate is the monthly Federal Reserve Index of Industrial Production. The denominator is the Index of Industrial Capacity, which represents a "realistically sustainable maximum level of output for that industry, rather than some high, unsustainable, short-term maximum."[17]

**Figure 2.5 Ratio of Actual to Potential GDP**

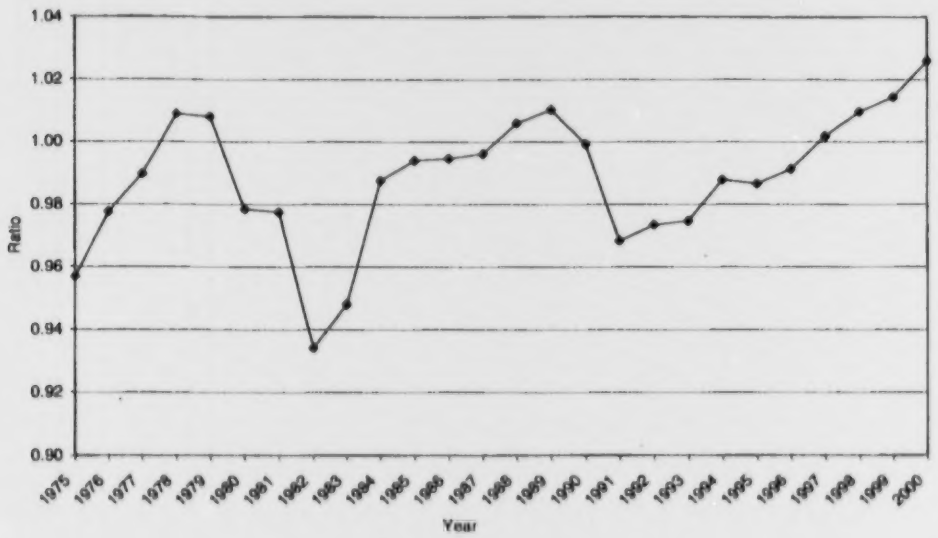


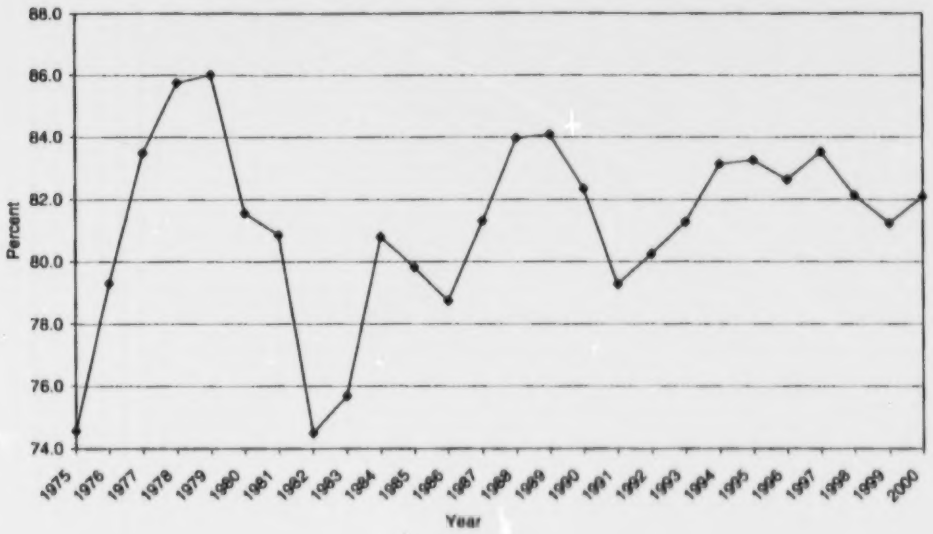

Figure 2.6 shows the industrial CUR series for the entire industrial sector over the 1975–2000 period.[18] As with the ratio of actual to potential GDP, the aggregate industrial CUR varies with the business cycle and ranges from 74.5 percent to 82.1 percent over the 1975–2000 period. It rose from about 75 percent in 1975 to 86 percent in 1979 before plummeting to 74.5 percent, its lowest level in the last three decades, in 1982. Since 1982, the aggregate industrial CUR has drifted up steadily, dipping slightly in the mid 1980s and early 1990s. It recovered during the 1990s but then fell during the last four years of the series. It is noteworthy that, even in this most recent period of sustained prosperity, the CUR of the industrial sector failed to exceed its peak value reached in 1979. Unlike the potential GDP utilization rate, the industrial CUR never exceeds 100 percent.[19]

## Indices of Human Capital Utilization

### Utilization of potential work hours

Using the estimate of potential work hours (discussed above) as the denominator and actual work hours as numerator, one obtains an indicator of the capacity utilization of human capital. This ratio is regularly

**Figure 2.6 Industrial CUR, Total Industry, 1975–2000**

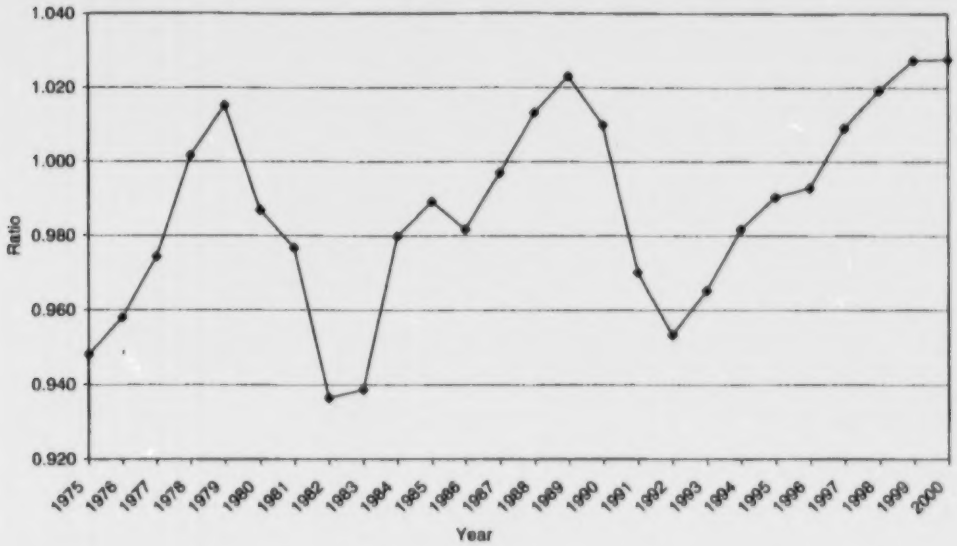



calculated by the CBO and is shown in Figure 2.7 for the period from 1975 to 2000. As with the other utilization indicators, this ratio varies over the business cycle, reaching a high of 103 percent in 2000 and a low of 94 percent in 1982. Unlike the CURs of the physical capital stock, this CUR exceeds 100 percent in 9 of the 23 years, including each year since 1996. Again, this pattern occurs because of the dependence of the estimate of potential work hours on the value of the NAIRU that underlies them. Note that the utilization rate of potential work hours gives equal weight to the work hours of high-skilled and low-skilled people when, in fact, the utilization of high-skilled hours contributes more to output and productivity than does the use of low-skilled hours. The utilization rates based on the EC concept that we estimate in this volume reflect these differences in productivity among workers.[20]

### Employment rates

The employment/labor force ratio, defined as the percent of the nation's workforce between the ages of 18 and 64 that is actually employed in a job, is shown as the top line in Figure 2.8. This ratio is also a crude indicator in that it counts holding any job during a year—full time, full year; part time, part year; or any combination of these—

**Figure 2.7 Ratio of CBO Actual to Potential Hours Worked, 1975–2000**

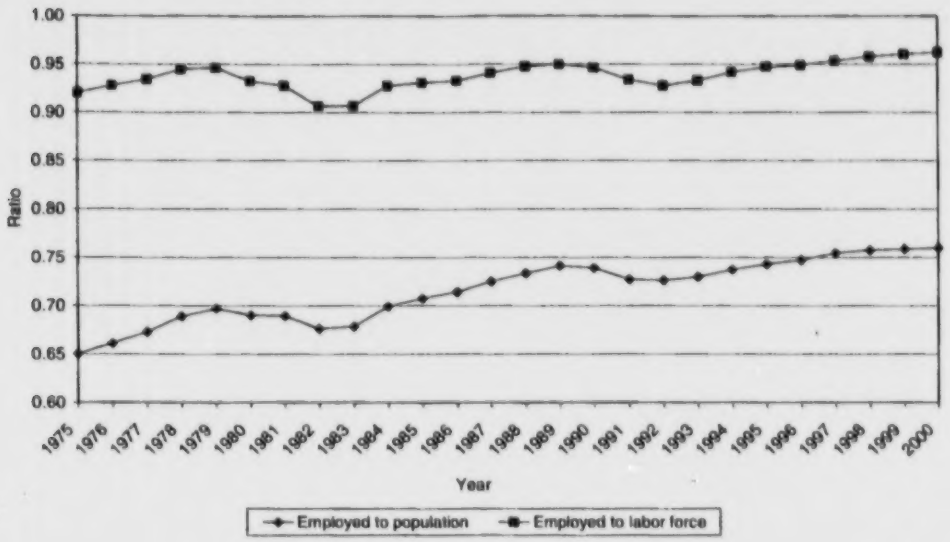



as being employed. Hence, the extent to which the standard work hours in a year are spent in employment is not considered in this indicator. This ratio also ignores the differences in human capital which workers of various characteristics are able to bring to bear in employment. Similar to many of the ratios presented thus far, the denominator of the employment/labor force ratio also varies over the business cycle, with people moving into and out of the labor force in response to their perceived chances of finding work.[21]

Related to the employment/labor force ratio is the employment/population ratio, defined as the ratio of the employed working-age population to the entire working-age population. Because a number of working-age citizens are neither employed nor seeking work (that is, they are out of the labor force), the employment/population ratio lies below the employment/labor force ratio.

As seen in Figure 2.8, both employment rates roughly parallel the aggregate performance of the economy, though the employment/labor force ratio corresponds more closely to the cyclical pattern of other indicators of the economic cycle. The employment/labor force ratio reached its peak value of 96 percent in 2000; it had fallen as low as 91 percent in 1982 and 1983. The employment/population ratio ranged

**Figure 2.8 Ratios of Working-Age Employed to Population and Labor Force**




from 65 percent at the beginning of the period to over 75 percent in 2000. In the years since 1993, this rate reached its highest level during the last three decades.[22]

Note that both of these human CURs reflect simple counts of people (population, labor force, and employed persons) and, hence, reflect neither the differential productivity nor the differential intensity of employment among the individuals. Again, the CURs based on the EC concept presented below reflect both the differential valuation and employment intensity considerations in measuring the capacity utilization of the human capital stock.

A comparison of Figures 2.7 and 2.8 indicates the greater cyclical sensitivity of the actual work hours series relative to that of the employment series, consistent with the concept of labor as a quasi-fixed production factor, developed by Walter Oi (1962). Oi's analysis suggests that those inputs which tend to have high fixed costs to the employer—and low degrees of substitutability with the fixed factors—will experience relatively small changes in response to changes in product demand, relative to those inputs with low fixed costs. While high fixed hiring/firing and training costs reduce the cyclical sensitivity of employment, hours worked are not so constrained. During the

recession of the early 1980s, we observed that the employment/population ratio fell by 3 percent (from 0.70 to 0.68) and the employment/labor force ratio by 4 percent (from 0.95 to 0.91) (Figure 2.8), while the ratio of actual to potential work hours fell by 8 percent (from 1.02 to 0.94) (Figure 2.7). The comparable changes during the recession of the early 1990s are 1–2 percent for the employment ratios, compared with 7 percent for the work hours ratio.

## SUMMARY OF PRODUCTIVE CAPACITY AND UTILIZATION PATTERNS

In this chapter, we have presented a wide variety of statistical series describing the physical and human capital available to sustain production in the United States. Additional series describing the levels and trends in the utilization of the capacities have also been presented. All of these series have been produced by federal government statistical agencies and are regularly reported by them and the media.

Table 2.1 summarizes the levels and patterns of the series describing the nation's physical and human capital stocks. In terms of total productive capacity, the most comprehensive indicator is potential GDP, which stood at a little less than $10 trillion in 2000 (row 1). Over the 25-year period, this potential output measure has grown by about 3 percent per year. The three capital stock series (rows 3–5) grew at quite different rates over the period, with the stock of private nonresidential capital growing at an average annual rate of 3.07 percent, well in excess of the others. The nation's total stock of physical capital nearly doubled over the entire period, increasing from $8.63 trillion in 1975 to $16.44 trillion in 2000 (row 3).

The human capital stock indicators are particularly crude and reflect only counts of potential person hours or people. Hence, they fail to distinguish among these units according to the potential productivities that they embody. All of the indicators of the potential human capital stock have grown by less than 2 percent per year. The number of *actual* work hours, on the other hand, grew by more than 2 percent per year. The far more rapid growth of the labor force relative to the working-age population is reflected in the rising labor force/population

**Table 2.1 Summary of Indicators of Physical and Human Capital Stocks, 1975–2000**

| Indicator | 1975 Level[a] | 2000 Level[a] | Ratio: 2000 to 1975 value | Annual percentage growth rate, 1975–2000 |
|---|---|---|---|---|
| Aggregate national productive capacity | | | | |
| Figure 2.1: Potential GDP | $4.56 trillion | $9.71 trillion | 2.13 | 3.07 |
| Figure 2.1: Actual GDP | $4.37 trillion | $9.96 trillion | 2.28 | 3.37 |
| Physical capital (capital stock) | | | | |
| Figure 2.2: Private nonresidential capital | $5.03 trillion | $10.69 trillion | 2.13 | 3.07 |
| Figure 2.2: Government capital | $3.60 trillion | $5.74 trillion | 1.59 | 1.89 |
| Figure 2.2: Private nonresidential and government capital | $8.63 trillion | $16.44 trillion | 1.90 | 2.61 |
| Human capital | | | | |
| Figure 2.3: Potential work hours | 122.1 billion hours | 185.0 billion hours | 1.52 | 1.68 |
| Figure 2.3: Actual work hours | 115.8 billion hours | 190.1 billion hours | 1.64 | 2.02 |
| Figure 2.4: Working-age population | 123.2 million people | 169.0 million people | 1.37 | 1.27 |
| Figure 2.4: Civilian labor force | 87.1 million participants | 133.3 million participants | 1.53 | 1.72 |
| Figure 2.4: Labor force/population ratio | 0.71 | 0.79 | 1.11 | 0.44 |

[a] Dollar figures are in 2000 dollars.

ratio—a greater share of the working-age population was available for work in 2000 (79 percent) than in 1975 (71 percent).

Table 2.2 indicates patterns of utilization of both the human and physical capital stock. In nearly all cases, the low value of the utilization indicator occurs during the recession of the early 1980s, while the high value has been experienced in the most recent year, 2000. The variation between the highest and lowest of these utilization rates is rather small, with the ratio of the highest to lowest values recorded over this period ranging from 1.05 to 1.17.

These series provide the nest into which our estimates of the human capital stock and its utilization, based on the EC concept, will be set. As we have indicated, the standard indicators of the human capital stock and its utilization are far less comprehensive and precise than are those for physical capital. They fail to account for differences among human capital units (hours or persons) in terms of potential contributions to output; those measures that are person counts also fail to reflect variations in potential work time. The EC-based series that we develop in subsequent chapters seek to improve on these measures

**Table 2.2 Summary Indicators of U.S. Capacity Utilization**

| | Low value (Year) | High value (Year) | High value/ low value |
|---|---|---|---|
| National productive capacity utilization | | | |
| Figure 2.5: Potential GDP utilization rate | 0.93 (1982) | 1.03 (2000) | 1.11 |
| Physical capital utilization | | | |
| Figure 2.6: Industrial capacity utilization rate | 74.5 (1982) | 86.0 (1979) | 1.15 |
| Human capital utilization | | | |
| Figure 2.7: Utilization of potential work hours | 0.94 (1982) | 1.03 (2000) | 1.10 |
| Figure 2.8: Employment/labor force ratio | 0.91 (1982, 1983) | 0.96 (1998–2000) | 1.05 |
| Figure 2.8: Employment/ population ratio | 0.65 (1975) | 0.76 (2000) | 1.17 |

by incorporating individual specific measures of embodied human capital that reflect variations in both quantity and price.

## Notes

1. When first calculated, a 4 percent unemployment rate was used; however, by the late 1970s, a 5.1 percent unemployment rate was taken as full employment.
2. See Okun (1965) and Smith (1985).
3. Note that the "output per hour of labor time" component of this calculation incorporates the contribution of the nation's stock of physical capital when it is employed in combination with labor.
4. U.S. CBO (1995). See also Aaron, Bosworth, and Burtless (1989). CBO's approach for estimating historical values of potential output is based on a neoclassical economic growth framework, and it relies on a production function in which the nation's output $Y$ depends upon the input of labor $N$ and capital $K$: $Y = F(N,K)$. This straightforward relationship, combined with assumptions about the growth of the labor force (e.g., hours worked), capital stock, and total factor productivity, determines how potential output will grow over the long run. Output estimates for the nonfarm business sector (the largest productive sector of the economy), hours worked, and total factor productivity are set at their "potential" levels, and the actual capital stock is taken to be the potential capital stock. The labor input component rests on an estimate of the NAIRU (nonaccelerating inflation rate of unemployment), and the capital stock is measured as an index incorporating differential productivity levels of a variety of types of capital; it is designed to measure the flow of capital services available for production. The CBO capital input series, taken to be a measure of the flow of capital series available for production, is an index based on the net stock of capital (in constant dollars), adjusted for varying marginal productivity estimates among various types of capital. (This series is measured by the Bureau of Economic Analysis [BEA] in the U.S. Department of Commerce; see below.)
5. We obtained potential GDP and actual GDP series from 1975 to 2000, in billions of current dollars, from Table 1 "CBO's Method for Estimating Potential Output: An Update" in U.S. CBO (2001). The series was converted to constant 2000 dollars using the GDP implicit price deflator from the *Economic Report of the President 2001*, Table B-3 for the years 1975–1999, and from Robert Arnold of the CBO for the year 2000.
6. During the most recent period (1997–2000), potential GDP grew at an annual rate of 3.6 percent. If the final three years of the series are eliminated—years when actual GDP greatly exceeded potential GDP—actual GDP grew by 3.2 percent per year and potential GDP by 3.0 percent. The very rapid growth of the potential GDP series at the end of the period is largely due to modifications by the CBO after 1995 in the calculation of capital inputs. After 1995, CBO expanded the breakdown of producers' durable equipment from two categories (computers and noncomputers) to four categories (computers, software, communications equip-

ment, and other). Previous publicly available figures, available in U.S. CBO (1995), do not reflect this modification. This modification raised the annual growth rate of the capital input sector of the model by 0.2 percent over the 1990s and by 0.1 percent between 1960 and 2000 (see footnote 4 and U.S. CBO [2001]). Consequently, growth in potential GDP exceeded actual GDP growth for these last few years—in spite of rapid actual economic growth during this period.

7. A description of the estimates published prior to 1989 is in U.S. Department of Commerce, BEA (1993, 1998). The current methodology and estimates are described in Katz and Herman (2000).
8. The stock is referred to as "net" because the gross value is adjusted for depreciation, reflecting the annual decline in the value of the stock due to wear and tear and obsolescence. Adjusting for depreciation allows the measure to more closely reflect the potential contribution to production capacity of the existing capital stock. A time series of the Gross Reproducible Tangible Wealth stock, ignoring depreciation, is also available from the BEA.
9. Oliner (1989) described the purpose of this aggregate series as follows: "The BEA has never attempted to construct capital measures that are suitable for the analysis of output and productivity. Instead, its main objective has been to develop . . . estimates of national wealth. Accordingly, the BEA constructs estimates of capital stocks that represent the cost of purchasing tangible capital, not the service flow provided by that capital in a given period" (p. 773).
10. See tables 1.1 and 1.2 at the BLS Web site for the series from 1925 to 2000 (available at <http://www.bea.doc.gov/bea/dn/facd/> extracted on October 17, 2001). The levels of these net stocks are calculated as the cumulative value of past gross investment less the cumulative value of past depreciation. Detailed type-of-asset calculations underlie the aggregate capital stock values that are calculated and published. While the published numbers are in current dollars, the calculations are done in constant dollars and then reflated using chain-type price index series. The published series are in 1996 dollars. We obtained the implicit price deflator by dividing each year's nominal value by the real value and then recalibrated the values from 1996 dollars to 2000 dollars.
11. See Oliner (1989). The primary objective of the BEA series is to assist in constructing depreciation estimates for the national accounts and not the analysis of output and productivity. Although this series does not reflect the flow of services from the capital stock, it is an indicator of the productive capability of this important contributor to the nation's ability to produce.
12. Like the BEA, the Federal Reserve Board regularly estimates a capital stock series, in this case for the manufacturing sector (a component of the entire industrial sector). This series measures dollar value of the net capital stock available to the manufacturing sector, net of depreciation. Hence, it indicates the potential productive capacity of the manufacturing sector. This series is regularly described and reported in the Federal Reserve Bulletin. The published series suggests that the manufacturing capital stock is about 20 percent of the private nonresidential capital stock.

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13. Potential work hours are estimated using a cyclic-adjustment equation that relates the percentage difference between actual and potential employment to the difference between the actual unemployment rate and the "unemployment gap" (reflecting the estimated NAIRU). The estimation procedure is described in U.S. CBO (2001).
14. These indicators are published regularly by the U.S. Bureau of the Census and the Bureau of Labor Statistics (BLS), and are obtained from the annual CPS, a survey of 50,000 U.S. households.
15. As described above, full employment is consistent with the estimate of the unemployment rate consistent with the NAIRU.
16. The level of actual GDP exceeds potential GDP in a number of years. This is possible because estimates of potential GDP are based on assumptions of the NAIRU, and actual output may well exceed this level in any given year. Estimates of the difference between potential and actual GDP based on somewhat different assumptions and statistical procedures are also made by the International Monetary Fund, the Organization for Economic Cooperation and Development (OECD), and Data Resources, Inc. This indicator is often reported as the GDP gap, the absolute difference between potential and actual GDP.
17. See Raddock (1990). Raddock emphasized that the capital stock in a sector is one of several factors that determines the capacity output of the sector and noted that the relationship between capital input and capacity output is variable over time and across industry. He stated that, "The capacity indexes are developed from a variety of capacity, utilization, and related data and . . . are designed specifically to be used with the industrial production indexes" (p. 411). See also Oliner (1989) and Gilbert and Raddock (1999).
18. Utilization rate series are also available for the manufacturing, mining, and utilities components of the entire industrial sector.
19. This is consistent with the concentration of growth during the recent expansion in sectors other than the industrial production sector.
20. The average work week is often employed as an indicator of the extent of work intensity in the U.S. economy. However, this measure is calculated over only the employed working-age population, and typically over the employed wage and salary population. As such, it reflects the extent of work among typically full-time workers. Since 1975, it has ranged from about 1,870 hours per year to nearly 1,950 hours per year in the United States, which has the highest level among the major industrialized countries (see Fitzgerald 1996). This indicator has shown very little tendency to decrease over the last several decades. Dramatic changes in work patterns across genders, periods, and ages have been documented over the past several decades (see McGrattan and Rogerson 1998).
21. The complement of the employment/labor force ratio is the unemployment rate for the nation's working-age population. The unemployment rate is defined as the percent of the nation's labor force between the ages of 18 and 64 that is looking for work but unable to find it. The unemployment rate weights each unemployed labor force participant equally, irrespective of the human capital which the worker

is able to bring to bear in the employment process. It also fails to reflect the amount of work for which the person is looking or is willing to do (e.g., full- or part-time employment). Because the denominator of the rate also varies over the business cycle, with people moving into and out of the labor force in response to their perceived chances of finding work, the unemployment rate may fail to accurately reflect the extent to which the nation's available labor pool cannot find work. The dependence of the size of the labor force on the macroeconomic performance of the economy is related to the concept of the "discouraged worker," the potential worker who is not a labor force participant because of discouragement over the prospects of finding work. See, for example, Juhn, Murphy, and Topel (1991) and Clogg and Sullivan (1983). The unemployment rate tracks the business cycle and has fallen from 8 percent in 1975 to 5.4 percent in 1979. The rate skyrocketed to 9.3 percent in the recession of the 1980s but then drifted down to 5 percent in 1988. The recession of the early 1990s saw the rate peak at 7.3 percent, but by 1997 it had fallen to its low point of the entire 25-year period at 4.7 percent.

22. These series are available by using the "Selective Access" section of the BLS Web site, <http://www.bls.gov> extracted in October 2001. The specific series codes are available upon request from the authors or the BLS itself.

# 3
# The Concept of Human Capital
## A Framework

In this chapter, we present a framework for analyzing the concept of human capital. Using this framework, we identify alternative concepts of the value of the human capital stock and indicate the basis for the standard definition of human capital found in the economics literature. Research studies that attempt to measure human capital rest on some definition of this concept, and this framework makes clear the definitions that are used. In Chapter 4, we review the prior theoretical and empirical human capital literature and show the linkages between this work and the framework presented here. The strengths and weaknesses of the EC indicator of human capital we present in Chapter 5 are seen more clearly when it is related to this framework.

Consider an individual at some point in her life, say age 16, who possesses some level of knowledge and skills. She engages in activities that contribute to the production of goods and services that are of value to the citizens of the nation, including herself. In the course of living and contributing to production, she uses up (or consumes) a variety of goods and services and, hence, the resources that are allocated to these outputs. Therefore, she both contributes to social output and uses up resources that could be used to produce other things of value to society if they were not diverted to her. Consistent with economists' views, the value of her contributions to goods and services is measured by the willingness of people to pay for them; the value of the resources consumed is measured by the full social opportunity costs associated with them.

Assume that, for the current and each future year of her life, we know both the value of what she contributes to society's output, and the value of social resources that she uses up or consumes. If we know the rates of time preference—or interest rates—of people who are positively and negatively affected by her activities, we can account for the fact that the value today of these future streams are worth less than if

they were realized immediately. With this information, we can calculate the *present value* of the full lifetime stream of both the positive and negative contributions of her activities to social output.

The difference between the present value of her contributions to social output—call it her *gross product*—and the value of the social resources that she consumes is her net contribution to the nation, her *net product.*

Depending on one's perspective, the value of this person's human capital can be taken as either her gross product or her net product. As we will see in Chapter 4, most economic analyses of human capital accept the Gross Product concept—the *discounted present value of her lifetime stream of gross output*—as her human capital. By summing the present value of either the gross or net output values over all of the citizens in the nation, we arrive at the concept of the aggregate national stock of human capital.

## THE ANNUAL FLOW OF HUMAN CAPITAL OUTPUTS AND COSTS: A SOCIAL BENEFIT AND COST FRAMEWORK

So far we have spoken of the discounted present value of the aggregate of these positive and negative lifetime flows. It is helpful to decompose these values in order to clearly understand what is and what is not included in studies that define and measure the nation's human capital stock. Table 3.1 is designed to help us think about these components; it is simply an annual statement of the production and consumption activities of the people who comprise the society. The left side of the ledger tabulates contributions of these citizens to social output, and the right side calculates the value of society's resources that are consumed by the nation's citizens in any given year. Let us consider each of the two sides of the ledger, in turn.

### The Value of Gross Annual Product

The left side of the ledger itemizes the value of people's annual contribution to social output, the value of gross annual product

**Table 3.1 Value of Net Annual Product Balance Sheet**

| Value of gross annual product (VGAP) | Value of annual resource use (VARU) |
|---|---|
| Value of market production (MP). Often approximated by Earned Income (EI) (hourly market wage times hours engaged in market production) plus fringe benefits. | Opportunity cost of food, shelter, and clothing consumption (FSC). Often approximated using market prices. |
| Value of home production (HP). Nonmarketed; often approximated by hourly market compensation times hours spent in home production. | Opportunity cost of transportation and medical care consumption (TMC). Often approximated using market prices. |
| Value of volunteer activities (VA). Nonmarketed, approximated by hourly market compensation times hours spent in volunteer activities. | Opportunity costs of education and training consumption (ET). |
| Consumer surplus (CS) associated with MP, HP, and VA. | Minus producer surplus (PS) associated with FSC, TMC, and ET inputs when valued by market prices. |
| Value of leisure activities (LA). | |
| Value of external benefits (XB). Net value to society, in excess of MP + HP + VA + CS + LA. | Value of external costs (XC). Net value to society of costs in excess of FSC + TMC + ET. |

(VGAP). In making this tabulation, we adopt a comprehensive accounting stance and include all of society's members.

Some of the activities of people yield contributions to the output of goods and services that pass through a market. Neglecting the complexities of self-employment, workers are likely to be employed by a firm and compensated for their labor effort. If the economy is a smoothly functioning market economy, the hourly wage is an estimate of the value of one hour's contribution to output; annual earnings (including fringe benefits) equals the value of the contribution to output for the entire year. This annual return reflects the knowledge and skills (human capital) that people possess and apply to market work during the year. We label this component the value of market production (MP).

The logical underpinning of economics distinguishes an additional component of value beyond the market price of the goods and services

that are produced. To the extent that people are willing to pay more than this market price, those purchasers of the goods and services realize a surplus. This consumer surplus (CS) is in addition to the value that the market places on goods and services that are produced. If the value of market production is measured using the market price of the output (as opposed to the full willingness of people to pay), the value of consumer surplus must also be included in the account. We enter it on the left side of the table after discussing the surplus values associated with other activities in which citizens engage.

The second entry on the left side of the ledger is the value of home production (HP). In addition to productive activities that earn market rewards, citizens spend time in home-based work activities—caring for children, household maintenance, cooking, and numerous other tasks. These contributions to social output do not pass through a market, and people do not receive a monetary payment for doing them. Nevertheless, these contributions are as real as contributions that pass through a market; they also have value. Thus, a question arises concerning how to value such output.

Analysts often use an estimate of the market wage (including fringe benefits) that the person is (or would be) paid for market production as an approximation to the value to the individual of an hour spent in home production. The logic behind this reasoning is straightforward. If we assume, for a moment, that the individual allocates time over market production and home production, we know that each hour of market production earns her compensation equal to her market wage. Each hour of home production also grants "value" to her. Thus, one estimate of the value of home production is the hours spent in home production multiplied by the market wage rate (estimated if necessary and defined to include fringe benefits) to yield the aggregate value of home-based productive activities.[1]

Of course, one implication of this reasoning is that producers of home production receive value above their market wage rates. We will address this producer surplus in the next section. However, given the market compensation proxy for home production, there will also be consumer surplus associated with home production. As we noted in our discussion of market production, when market prices are used to value these productive human capital activities, the estimated amount will

understate the full willingness to pay. We therefore separately account for this consumer surplus in Table 3.1.

After allocating time to the market and to the home, citizens have some time left for volunteer activities—time contributions to church, the local food pantry, neighborhood association, school, and so on. The hours that people spend in volunteer activities also yields services that are valuable to society, and again the appropriate concept for measuring the value of these services is the willingness to pay of all those who directly benefit from these outputs.

In practice, it is devilishly hard to approximate this value. Again, the hours do not pass through a market, and the value placed on them by the individual may be quite different than the value placed on them by society. However, as with home-based activities, analysts often equate the value of an hour of volunteer activities with the value of an hour of market production, again multiplying an estimate of hourly compensation by the number of hours citizens are engaged in volunteer activities. The logic is analogous to that used in the discussion of home production, extended to three activities. We enter the value of volunteer activities (VA) as the third item on the left side.

Again, this estimate, based as it is on market values, neglects the implicit consumer surplus associated with volunteer activities. As we have noted, if the valuation of these productive human capital activities is based on prices reflected in the market, the estimated product will understate the full willingness to pay. To acknowledge this, we collect the consumer surplus values associated with market productive activities, home-based production, and volunteer activities when valued by market prices. We include this consumer surplus in the left column of the ledger and label it CS.

Beyond the hours not required for sleep and maintenance or used in these productive activities, people have residual hours of leisure that yield utility or well-being for themselves. Because each individual citizen is included as a member of society, the value of these leisure activities must also be tallied. The willingness to pay principle that guided the valuation of market, home-based, and volunteer activities also serves as the conceptual basis for valuing leisure hours. As with the other nonmarketed activities, analysts have attempted to use the expected market wage of people to approximate the value of their lei-

sure hours. We include the willingness to pay for hours used in leisure activities as an entry in our table and label it LA.

The last entry in the left column captures an important, but so far neglected, aspect of the value of the productive activities of citizens. To this point, we have assumed that the value of market, home-based, volunteer, and leisure activities can be secured from assessments of members of society (including the person whose human capital services are being valued) who directly benefit from these activities. In fact, these activities, particularly home production and volunteer activities, may increase the well-being of members of society who do not directly gain from the goods and services generated. For example, citizens in general may experience feelings of altruism (or "warm glow") when observing the benefits from the services of other citizens engaged in socially productive volunteer activities. This extra "spillover" or external value constitutes additional output, for example, in the form of better urban living conditions due to decreased homelessness, crime or drug addiction, and must be included on our ledger. We label these external, "public good"-type benefits XB.[2]

The sum of the items in the left column of the ledger, then, is the annual social value of the productive activities of citizens, with given education, training, skills, and other human capital characteristics. Because it captures the value of the services yielded by the human capital of citizens, without taking account of the social costs entailed in producing these outputs, this sum forms the gross annual return on human capital. When aggregated over all citizens in society it is the value of gross annual product of the human capital of the society.

**The Value of Annual Resource Inputs**

Consider a unit of physical capital, such as a truck. For the truck to function productively, inputs for the operation, maintenance, and repair of the truck are required. In calculating the net value of the productive services of the truck to society, the analyst needs to take account of the value of these required inputs. The same is true of services rendered by people who embody human capital. Hence, we need a right side of the ledger to reflect the value of the annual resources diverted from other social uses in order to support and sustain the productive activities of

human capital. These resources enable the person to live, work, and contribute the gross output indicated on the left side of the ledger.

Many of these inputs pass through a market, thus valuing the opportunity cost to society in providing them to the individual is straightforward. However, the generation of these human-capital-supporting inputs may also generate surpluses—a "producers surplus"—that needs to be taken into account in assessing these social opportunity costs. Moreover, the production and use of these goods and services may also impose external costs on society that are not reflected in market prices, and these costs must be included as well.

The primary required resources can be categorized in a rather straightforward manner. In each case, it is the value of these inputs to society that must be assessed: food, shelter, and clothing—the basic necessities of life; transportation and medical care—other necessities with cost structures that are different from food, shelter, and clothing; education and training—inputs supporting investments in human capital that will be used in productive activities in future periods; producers surplus—an offset to the market price of these required inputs, reflecting opportunity costs of productive factors which lie below market prices; and external costs—nonmarketed costs generated in the process of producing these inputs to human capital, for example increased congestion or pollution.

The first entry on the right side of the ledger is the value of annual food, shelter, and clothing consumption by people (FSC). In concept, the social opportunity cost of these goods and services is the amount that would have to be paid to each unit of labor, land, and capital in order to divert it from some other activity into the production of food, shelter, and clothing. A proxy measure of the opportunity cost of a unit of any one of these is its market price. The value of the annual resource use of these goods and services is then the amount of each purchased multiplied by its market price.

If this market-based value is used to establish the value of food, shelter, and clothing, social opportunity costs will be overvalued. Consistent with the standard economic argument regarding increasing costs, each successive unit of goods and services costs more to produce than the previous one.[3] However, the market price reflects the required cost to produce the last (or marginal) unit of these goods and services. If we value all the units produced at that market price, we overstate the

total value of resources used. The magnitude of this overstatement is known as producer surplus and must be subtracted from the total value of resources used on the right side of the ledger.

The second entry, transportation and medical care (TMC), also reflects the value of inputs required for the productive use of human capital. The value of transportation and medical care is the social opportunity cost of the labor, land, and capital resources used in the production of these services, and analysts have made use of their market prices in developing proxies for the more difficult-to-measure, but conceptually accurate, social opportunity cost valuation. As we described above, such market prices tend to overstate the full social opportunity cost by the amount of producer surplus; again, an offset is required. However, in the case of transportation and medical care, market prices are far less reliable proxies of social opportunity costs than for food, shelter, and clothing. Both medical care and transportation services enjoy public subsidies, which lead to market prices that do not accurately reflect social costs. Hence, we include them separately in the ledger.

The third entry, the value of education and training (ET) services consumed, represents the full social opportunity costs of the resources allocated to activities that augment the level of individual human capital stocks during a year. Unlike other real resource inputs required for productive activities that employ human capital—for example, consumption represented by food, shelter, and clothing—the resources consumed for investments in human capital do not yield immediate increases in the value of productive activities that are reflected in the left side of this year's ledger. The added human capital stock will only be put to productive use in future periods, yielding gains in gross annual product in these "out" years. For example, if the value of an hour of a person's contributions to market production is proxied by the hourly wage, the returns from the augmented human capital at the end of period $t$ will be reflected in a higher hourly wage in future periods, implying increased market productivity in these periods. Because the gross value of a person's human capital stock is the *discounted present value of the lifetime stream of her gross outputs*, the gains which offset the value of the education and training resource costs are reflected in the value of the human capital stock.[4]

As with transportation and medical costs values, the market price of education and training is a weak proxy for the relevant costs, due to public subsidies to both students and schools. And, as with both of the first two elements, producers surplus values will not be reflected in education and training costs if market prices are used to assess the value of this resource use; again, these must be reflected as an offset on the right side of the ledger.

The next entry on the right side of the table is producers surplus (PS). The value of the surplus is entered in the ledger with a minus sign, as it serves to offset the overstated costs of the other elements when measured by market prices. As we have noted, if the valuation of the resources consumed in supporting the productive use of human capital is based on implicit or explicit market prices, the estimated value will exaggerate true social opportunity costs. Hence, we collect the producer surplus values associated with market-based estimates of these resource costs and enter them on the right side of the ledger as an offset to the estimate of total resource cost based upon market values.[5]

External costs, XC, the final entry on the right side of the ledger, have the same conceptual basis as the value of external benefits listed on the left side. To the extent that those who bear the direct opportunity costs of the resources consumed in supporting the productive use of human capital do not experience the external or public goods costs of this consumption, they must be reflected in a separate entry in the ledger. An example of such costs borne by society but not directly reflected in the consumption of resources listed in Table 3.1 are the pollution or congestion costs that may be associated with these uses of labor, land, and capital resources.

The sum of the items on the right side of the ledger is the annual social opportunity costs of the consumption of resources that support the productive activities associated with the use of human capital. When this sum is aggregated over all citizens in society, it is the value of annual resource use (VARU) associated with the use of the human capital of the society.

### The Net Annual Social Return on Human Capital

We can now combine the two sides of the ledger. The gross annual value to society of the productive activities of human capital (the left

side) minus the costs of the real consumption attributable to these activities (the right side) is the value of net annual product (VNAP) of human capital—the value of the net annual contribution of human capital to aggregate output. It can also be considered the net annual social benefit of human capital or the return on the stock of human capital existing at a point in time.

## THE AGGREGATE VALUE OF THE HUMAN CAPITAL STOCK

As we emphasized previously, the aggregate social value of the human capital stock is the discounted present value of the lifetime stream of the annual product of the human capital stock existing in the society at a point in time. We then viewed the components as a "snapshot" of this stream and discussed the gross and net concepts of the return on the human capital stock. By applying the annual return concepts to the present discounted value concepts, we begin to see how to value the stock of human capital at a point in time. For example, the aggregate social value of the human capital stock can be tabulated as a gross value, accounting for only the lifetime value of the items on the left, or output, side of the ledger in Table 3.1 (the value of gross annual product). Alternatively, the social value can be tabulated as a net value, subtracting the value of the lifetime stream of annual resource use. This latter, or net, concept of human capital is the discounted present value of the lifetime stream of the value of net annual product.

Given the number and composition of the people living in a nation, these gross and net human capital concepts can be stated more formally. We start with value of gross annual product. For any individual, the value of gross annual product is the sum of the value of that person's market production, home production, volunteer activities, and leisure activities plus any consumer surplus enjoyed by the purchasers of that individual's production, plus any external benefits enjoyed by society. That is, for individual $i$ in period $t$,[6]

$$(1)\quad VGAP_{it} = MP_{it} + HP_{it} + VA_{it} + LA_{it} + CS_{it} + EB_{it}.$$

Then, the gross human capital (GHC) embodied in individual $i$ at a particular point in time is just the present discounted value of that person's *VGAP* series:

$$(2)\quad GHC_i = \sum_{t=1}^{T_i} \frac{VGAP_{it}}{(1+r)^t}.$$

For the purposes of exposition, we assume here that the particular point in time is labeled period 1, period $T_i$ is person $i$'s last period of production, and that the discount rate $r$ (which reflects the fact that returns in later periods are worth less than those in earlier periods) is constant across people and through time. The value of the gross human capital in a nation (at a point in time) is then the sum of gross human capital embodied in all individuals:

$$(3)\quad GHC = \sum_{i=1}^{I} GHC_i.$$

Turning to the right side of the ledger, as we saw previously, the value of annual resources used for any individual is the sum of the opportunity cost of food, shelter, and clothing, transportation and medical care, and education and training, minus any producer surplus enjoyed by individuals producing those inputs, plus any external costs imposed on society. That is,

$$(4)\quad VARU_{it} = FSC_{it} + ET_{it} - PS_{it} + XC_{it}.$$

Then the value of the lifetime resources used (*VLRU*) by individual $i$ at a particular point in time is just the present discounted value of that person's VARU series:

$$(5)\quad VLRU_i = \sum_{t=1}^{T_i} \frac{VARU_{it}}{(1+r)^t}.$$

The value of resources used in a nation (at a point in time) is then the sum of the value of lifetime resources used by all individuals:

$$(6) \quad VLRU = \sum_{i=1}^{I} VLRU_i.$$

Now, recall that we defined *VNAP* as the value of an individual's gross annual output minus the value of her annual resources used. That is,

$$(7) \quad VNAP_{it} = VGAP_{it} - VARU_{it}.$$

From the above equations, we can see that the net human capital (*NHC*) embodied in an individual is simply the present discounted value of her net annual production and that the net human capital in a nation is the sum of the net human capital embodied in its citizens:

$$(8) \quad NHC = \sum_{i=1}^{I} \sum_{t=1}^{T_i} \frac{VNAP_{it}}{(1+r)^t}.$$

Although this final equation seems straightforward, a few moments of thought will make clear just how difficult it would be to calculate this value for even a single person. While some of the more tangible values (e.g., the value of market production) can be estimated, even these have wide uncertainty bands around them. Moreover, when these values are approximated by market prices, consumer surplus estimates must also be made. Many of the other components of gross or net human capital, however, can only be crudely estimated. Deriving a reliable estimate of the full human capital stock for a nation is a staggering task, requiring extensive knowledge of both current and future expected values.

This comprehensive human capital framework that we have laid out, then, describes how a person with full knowledge would proceed in estimating the human capital value of individual people and then aggregating these values to obtain an estimate of the human capital value of a society. The key advantage to a person with complete knowledge, relative to the real-time economist or national economic accountant, is the ability to provide accurate estimates of both the current and future values that are embodied in both the annual product and resource consumption sides of the human capital account. Rather than having to rely on proxies based on market values—hence, having to assess the value of consumer and producer surplus—the full willingness to pay and opportunity cost values would be known. Lifetime streams of these values would not have to be forecast but would be

known, as would changes over time in the composition of both the uses to which human capital is put and the resource consumption that supports the use and augmentation of human capital. The full return on investments in human capital would be known, eliminating the need to construct time profiles of the gains in productivity over time to education and training. Finally, the correct social discount rate necessary for calculating relevant discounted present values of future social gains from the use of human capital and future consumption costs required to support human capital uses would be known. In contrast, the economist or national economic accountant has to develop an estimate of each of these values components over time, often relying on crude evidence and unverifiable assumptions.

In the next chapter, we review a number of studies that have attempted to measure the annual return on human capital and others that have attempted to measure the "asset-value" of the stock of human capital that generates this return. In Chapter 5, we present our EC-based indicator of human capital. We will see that, like previous estimates of the human capital stock reviewed in Chapter 4, our measure is a partial measure of a comprehensive definition of human capital.

## Notes

1. This conclusion implies the standard economic assumption that each successive hour of home production yields less value than the previous hour. Given this, the individual will allocate hours to home production only if the value yielded exceeds the market wage. Once the value from home production falls below the market wage, the individual will stop allocating hours to that type of production and begin allocating hours to alternative activities.
2. While our examples indicate positive external effects, it should be noted that the productive activities reflecting the use of human capital may also generate negative effects. Hence, external benefits is appropriately thought of as a net value.
3. This argument is the flip side of the Law of Diminishing Marginal Returns. If returns on increased production inputs decrease, it follows that the costs associated with additional output will rise.
4. The decision to allocate time to education and training is more complicated than the decision to allocate time to other activities. The cost to society of an individual's choice to engage in education or training includes both the resource costs of the labor and capital inputs associated with the training and the value of the individual's time devoted to that training in terms of lost output. Like the decision to allocate time to home production or volunteer activities, the individual will allocate time to education and training as long as the value of that time to the individ-

ual exceeds the returns on time devoted to alternative uses. However, the time devoted to education and training results in an increment to human capital, which in turn raises the individual's future productivity and wage rate and thus the value of all forms of the individual's future productive activities. Economists have long estimated the value of future gains from resources devoted to human capital augmenting activities reflected in increases market earnings. Schultz (1961) is one early attempt. Psacharopoulos (1994) presented estimates with substantial global coverage. A comprehensive set of references to this literature can be found in Ashenfelter and Card (1999) and Card (1999). Haveman and Wolfe (1984) examined a comprehensive set nonmarket and external/public goods returns on schooling, most of which are not captured in the traditional "returns on schooling" estimates.

5. As with the value of consumer surplus, we include the producer surplus associated with the individual's own time spent in resource-using activities.
6. The components in Equation (1) should be thought of as dollar values. Thus, subscript *i* on *CS* and *EB* should be thought of as the consumer surplus and external benefits enjoyed by others when person *i* engages in market production, home production, and volunteer activities.

# 4
# The Concept of Human Capital

## Theoretical Underpinnings and Empirical Estimates

The past half century has witnessed the evolution of a large body of theoretical and empirical research exploring the concept of human capital and estimating the value of the nation's human capital stock. This research has also explored the concept and measurement of the level of human capital investment, and the processes by which human capital is formed and depreciated. In this chapter, we describe briefly some of the earliest and most basic studies of the concepts of human capital and its accumulation.[1] These contributions provide the conceptual backdrop to efforts to measure the value of the nation's human capital stock, which we also describe, and to our concepts of EC and its utilization.

### EARLY LITERATURE ON HUMAN CAPITAL: THEORETICAL CONTRIBUTIONS

The most basic of the theoretical contributions to this literature have identified human capital as a productive input to the nation's economy and proposed models describing the accumulation and depreciation of this input. These models draw from, and hence parallel, earlier analyses of physical capital and its accumulation and depreciation. These human capital models are a part of the basic structure of microeconomic analysis, and they form the foundation for research in fields such as the economics of education and the economics of health. They also provide the underpinnings for the extensive economic research on the returns to investments in education and job training.

## Jacob Mincer

Jacob Mincer (1958, 1962) is one of the earliest contributors to the human capital literature, and his work is truly ground-breaking. The basic issue that motivated Mincer's work concerned the nature of the relationship between the distribution of "ability" within the population and the distribution of earnings. He asked, "[If] abilities are perceived as distributed normally in the population, why is the distribution of [earnings] so sharply (positively) skewed?"

To answer this question, Mincer developed an economic model—known as the "human capital model"—in which observed earnings depend in a particular way on the "human capital" embedded in an individual. Mincer's human capital model proceeds in the following way.

- Assume that each individual has some initial level of basic or raw ability; this level forms her initial endowment of human capital at the beginning of the planning horizon. Across the population, this initial endowment is normally distributed.
- Any person is able to supplement her initial endowment through a variety of choices, such as participating in training programs, attending school, and/or working in a job that builds skills. While engaged in these activities, the individual earns no return from the use of her initial endowment of human capital. Thus, the individual foregoes these income returns when she augments her human capital in this way.
- The knowledge and skills that are acquired through these choices vary across these training, schooling, or experience activities; that is, the time spent in each activity will contribute differently to the individual's productivity.
- Moreover, work experience also contributes to human capital, and this experience varies with a person's age; hence, there is a distinct relationship between a working-person's age and knowledge and skills (or human capital) that have been accumulated through work experience.
- A worker's productivity and earnings thus depend in a specific way upon age as well as the choices made regarding education

and training relative to using human capital to earn income through work in a market activity.

It follows from these propositions that the distribution of annual earnings reflects the joint distribution of formal training (schooling) and on-the-job training (work experience and, hence, age), and the distribution of the initial human capital endowment (ability).[2] Even if the distribution of ability is distributed normally, the distribution of earnings need not be.[3]

Drawing on Mincer and our discussion in Chapter 3, we can write an equation that defines Mincer's concept of the human capital embodied in an individual.[4] Assume an individual with ability $a$ has completed $e$ years of training. Then, according to Mincer, her gross human capital is the present discounted stream of earnings she will receive over her lifetime.

$$(1) \quad GHC = V(a,e) = \sum_{t=e+1}^{T} E_t(a,e) \times \left(\frac{1}{1+r}\right)^{t-e}$$

where $V(a,e)$ is the present discounted value of the lifetime earnings of a person with $e$ years of training and ability, $a$, $E_t(a,e)$ is the annual earnings in year $t$ of that person, and $r$ is the discount rate. Equation (1) is comparable to the definition of gross human capital in Chapter 3, except that Mincer excludes the contributions of home production, volunteer and leisure activities, consumer surplus, and external benefits to human capital. As we saw in Chapter 3, these are also components of the value of the gross annual product and, hence, gross human capital.

Working from this simple framework, Mincer formulated several hypotheses regarding the earnings generation process—and the dependence of observed earnings on human capital.[5] For example, Mincer pointed out that if individual earnings are subject to random increases or decreases ("luck"), the distribution of earnings will tend to approach normality over time.[6] Or again, Mincer noted that if training is job specific, patterns of earnings variation will depend positively on both age and occupation.[7]

This framework has important implications for studying basic questions regarding the productivity-enhancing effects of additional schooling or training—or of work experience relative to formal training, of alternative types of training or work, or of other activities that

might contribute to productivity (e.g., preventive health activities, medical care). Because the choices of individuals in all of these dimensions involve trading off potential gains against costs, the framework has important implications for understanding human behavior and choices relating to schooling, work, and health care as well.

**Burton Weisbrod**

This basic contribution by Mincer initiated a long series of other contributions that expanded the human capital framework along both extensive and intensive margins. Burton Weisbrod (1961), writing shortly after the publication of Mincer's basic paper, expanded the human capital concept by including the value of resources used ($VARU_t$ in the terminology of Chapter 3) over the person's lifetime in the overall value of human capital. In Weisbrod's view, an individual's human capital is "the value of a person in terms of his worth as a productive asset" (p. 426), and it is a function of the gender and age of that person, as well as the resources she consumes.[8]

By subtracting the opportunity costs of consumption that supports the productive use of human capital, Weisbrod defines a net human capital concept, shown as Equation (2). Except for the subtraction of the resources consumed, Weisbrod's equation is similar to Mincer's equation. Again, the definition reflects the analytics underlying the economist's concept of physical capital. The net value of the human capital embodied in an individual with gender $g$ is the present value at age $z$ of the person's expected stream of future earnings, less that person's consumption of certain resources:[9]

$$(2) \quad HC = V(g,z) = S_{n=z}^{\infty}\left[Y_n(g,z) - (FC_n + TMC_n)\right] \times P_n(g,z) \times \left(\frac{1}{1+r}\right)^{n-a}.$$

Here, $Y_n(g,z)$ is the value of the productivity at age $n$ of a person of age $z$ (measured by her earnings), $FC_n$ is the value of food and clothing consumed by the person at age $n$, $TMC_n$ is the value of transportation and medical care consumed by that person, $P_n(g,z)$ is the probability of a person of age $z$ being alive at age $n$, and $r$ is the rate of discount.[10] Note that, in this framework, human capital depends upon a number of

factors, including the value of the output an individual generates during the current and each future year, the extent to which the person exercises this potential to produce, the value of certain resources consumed, the probability that the person will be living in each future year, and the discount rate used to translate future expected values into present values. In this view, then, the nation's human capital stock depends upon the future size and age-gender-education structure of the population, the future labor–leisure choices (age-specific labor force participation rates and observed annual work patterns; e.g., full-time vs. part-time work) of this population, as well as on the labor-market returns from working.[11]

Using this framework, Weisbrod developed an estimate of the aggregate *gross* value of U.S. male human capital in 1950 (in 1950 dollars) to be $1.335 trillion (discounted at a 10 percent rate) and $2.752 trillion (discounted at a 4 percent rate).[12] In estimating *net* male human capital, Weisbrod subtracted estimates of consumption expenditures taken from data on family consumption patterns from gross human capital.[13] These estimated values of net human capital are $1.055 trillion and $2.218 trillion at 10 and 4 percent discount rates, respectively.

### Gary Becker and Barry Chiswick

These early conceptual contributions to the definition of the human capital concept established the linkages among knowledge and skills and individual choices regarding training/schooling and work experience. They also established the linkages between these productivity characteristics and labor-market returns. These contributions led to many additional extensions of the human capital concept and to efforts to measure its level and trend. We mention only a few of them.

Gary Becker and Barry Chiswick, together and separately, advanced the understanding of the human capital concept and illustrated its important role in illuminating a wide variety of economic phenomena and behaviors that had, until then, remained on the fringes of economics. In one of their early contributions, Becker and Chiswick (1966) extended the original human capital framework so as to reflect the many different types of human capital investments among which individuals can choose.[14] In their framework, an individual's lifetime earnings is the sum of

- the present value of labor market returns (earnings) on "original" human capital (analogous to Mincer's "ability"),
- the present value of the stream of labor market returns on different investments in human capital, and
- an additional term reflecting the effect of luck and other factors on earnings.

Working from the assumption that an individual's annual earnings is equal to the annual labor-market return on her human capital, the Becker–Chiswick human capital equation for an individual is:[15]

$$(3) \quad HC = E = X + \sum_{j=1}^{m} \left( r_j \times C_j \right) + u,$$

where $E$ is the present value of the person's future expected earnings, $X$ is the present value of the stream of returns on the individual's basic abilities, $C_j$ is the amount spent by the person on the $j$th investment in human capital (out of a total of $m$ investments), $r_j$ is the present value of the annual return on that investment, and $u$ is the present value of the stream of "luck" and other factors. Note that the discount factors included in Equation (3) are not explicitly stated here, but are implicit in the $X$, $r_j$, and $u$ terms. Unlike Weisbrod's definition of net human capital, Becker–Chiswick employed a *gross* human capital concept, and did not account for the individual's use of resources in support of the productive use of human capital.

Using this framework, Becker and Chiswick derived the equilibrium level of human capital for an individual and showed that it depends on the rewards (net of investment costs) associated with an increment of skills and knowledge—an increment of human capital. In particular, annual net investment in human capital depends on the marginal rate of return on the investment (a decreasing function of the level of investment) and the supply of resources available for human capital investment (in the form of the marginal opportunity cost of these resources, which is an increasing function of investment).[16] It follows that the distribution of market earnings, which reflects the level of human capital, also depends on these return and cost (demand and supply) factors.

**Thomas Johnson**

The contribution of these early human capital theorists was formalized and extended by Thomas Johnson (1970). In his paper, Johnson placed these earlier formulations in a continuous time model (rather than viewing human capital investments as a series of discrete choices) and measured an individual's human capital stock by his (Johnson examined only males) *earnings capacity*, rather than his earnings. Johnson's model views an individual's earnings capacity as the sum of a base earning capacity (BEC), defined as, "The return on the initial endowment of human resources at the time the individual makes the decision to invest in human capital," (p. 546) and a continuous returns-from-human-capital-investment function. In his formulation, human capital investment depends on individual-specific returns on investment, the fraction of his earnings capacity that an individual invests in human capital, and BEC.[17]

The aggregate human capital indicator that we define and estimate in the Chapter 5 draws heavily on the human capital concepts developed in this early literature. Our indicator captures the annual potential return on human capital, rather than the stock of human capital discussed by the primary contributors to this early literature. Like Mincer and Becker–Chiswick, our measure is a gross, rather than net, human capital estimate; we do not include the annual resources consumed in support of productive human capital activities. Although we rely on market estimates of wages as the basis of our human capital measure, we follow Johnson in building from those observations to estimates of individual *potential* earnings. However, unlike Johnson's estimates of male human capital, ours are independent of the labor–leisure choices of the individual. Finally, like Becker–Chiswick, we incorporate a random component reflecting luck and other unobservable characteristics into our measure.

## THE LITERATURE ON HUMAN CAPITAL: EMPIRICAL CONTRIBUTIONS

The basic human capital concepts and theory summarized in the first section have spawned an enormous body of research within the field of labor economics. The 40-year history of this research encompasses analyses of schooling and training choices; the market returns associated with those choices; the determinants of individual earnings and the earnings distribution (including the independent effects of ability versus schooling); the determinants of educational attainment and the choice of occupation; the social returns on investments in education, training, and other forms of human capital investment; and the measurement of racial and gender labor-market discrimination within a human capital context.[18]

In addition, several researchers have attempted to measure the level of national human capital investment (in its various forms) and the value of the aggregate national stock of human capital. The research presented in this monograph follows in this tradition, and we discuss briefly the empirical work of the primary contributors to this literature.

### John Kendrick

One of the nation's most prominent national accounts scholars, John Kendrick, pioneered the study of both the size and growth of the nation's human capital stock. His research also touched on the extent to which this human capital stock is utilized. In 1976, Kendrick presented his earliest work on these questions. In developing a comprehensive set of national accounts, including a national capital account, Kendrick confronted the need to value the nation's human capital stock. His estimates of the human capital stock complement his measures of the value of nonhuman capital; in his framework, the sum of human and nonhuman capital represents total national capital (or real wealth).

Kendrick's approach to measuring the nation's human capital stock is "cost-based," in that human assets are valued by the investment costs embodied in them, rather than the returns that they are capable of generating over their lifetimes. In essence, Kendrick's approach focuses on a selection of the elements listed on the right-hand side of

Table 3.1, describing the cost of inputs that support the activities to which human capital contributes. This input-oriented perspective differs from the main thrust of human capital theory, in which the human capital stock is valued by the present value of the stream of outputs actually or potentially attributable to human capital—the concept represented on the left-hand side of the human capital table. For several reasons—for example, the levels of consumer and producer surplus and the public goods-type external benefits and costs of human capital use—the two sides of the table need not be equal when the framework is used to value the aggregate annual social product of human capital.

Given this framework, Kendrick defined the nation's stock of human capital to be the sum of rearing costs (the average variable costs of raising children to working age, taken to be age 14) plus the costs of ("intangible") human investments in education, training, health/safety, and mobility.[19] In the following paragraphs, the procedures adopted by Kendrick in securing these cost-based human capital stock estimates are briefly summarized.

In measuring rearing costs, Kendrick cumulated the average constant dollar rearing costs per child (up to age 14) over the number of persons in each age cohort, up to the cohort aged 95 years or more.[20] "Intangible human investments"—education/training, health/safety, and mobility—are also estimated by Kendrick at their cost.

In estimating the value of schooling investments in people, Kendrick distinguished among elementary, secondary, higher, and other education, and developed estimates of the value of resources dedicated to each component. The estimate of the value of these investment costs also includes the value of foregone earnings while individuals are in school. The value of resources devoted to training investments is separated into specific and general training costs incurred by firms.[21]

Kendrick's estimates of the cost of resources devoted to health/safety investments are based on business, personal, and governmental expenditures on these activities.[22] His estimates of "mobility" costs—unemployment, job-search, hiring, and moving costs—are all estimated on the basis of costs incurred, using crude indicators based on new hires rates, layoff rates, and ratios of work-oriented migrants to the labor force. In a final step, Kendrick adjusted these estimated human capital stocks for depreciation and maintenance.

Having obtained an estimate of the total national human capital stock for a point in time, Kendrick estimated the utilization of the human capital stock in the private domestic economy. First, he applied age-specific employment–population ratios to the cohort values of the stock (recognizing that this did not make allowance for the human capital devoted to unpaid economic activity). He then adjusted this estimate by the ratio of average weekly hours worked to hours awake (7 days times 16 hours per day equaling 112 hours per week). This adjustment implicitly assumes that the capacity use of human capital equals 112 hours per week, far in excess of the FTFY work standard of 40 hours per week.[23] These average adjustments are due to the use of aggregate data, rather than individual-level observations.[24]

This estimation procedure reflects several dubious assumptions and procedures, including the reliance on input values to estimate the value of lifetime productive contributions, the inclusion of only a selection of inputs to the production of human capital, and badly flawed empirical estimates of the values of these inputs.

As Table 4.1 indicates, Kendrick estimated the nation's human capital stock to be nearly $2 trillion in 1960 rising to $3.7 trillion by 1969 (in current dollars).

**John Graham and Roy Webb**

Several years after Kendrick's effort, Graham and Webb (1979) also attempted to measure the value of the nation's human capital stock. As opposed to the cost approach used by Kendrick, Graham and Webb used a present-value of expected earnings approach in their estimates, a definition derived directly from the human capital concepts of Mincer and Becker–Chiswick. Also, while Kendrick relied on coarse group data for his estimates, Graham and Webb made use of cross-section survey information. Unlike Kendrick, however, Graham and Webb estimated the human capital of the male population, rather than the entire population of males and females. A brief excursion into their procedure is warranted.

As a first step, Graham and Webb calculated time-series estimates of the earnings streams and wealth of the males in each of a set of birth cohorts. They obtained these values for their 1970 cross-section data by calculating the before-tax age-earnings and age-wealth profiles for

**Table 4.1 Estimates of the Value of Human Capital in the United States (Billions of Current Dollars)**

| Year | Jorgenson and Fraumeni (1989) (1) | Kendrick (1976) (2) | Graham and Webb (1979) (for males) (3) | Eisner (1980) (for males)[b] (4) | | Weisbrod (1961) (for males) (5) |
|---|---|---|---|---|---|---|
| | | | | Gross capital stock | Net capital stock | |
| 1950 | NA | NA | NA | 2,521 | 732.0 | 1,335 |
| 1960 | 29,604 | 1,901.4 | NA | 4,526 | 1,594.9 | NA |
| 1961 | 31,552 | 2,012.8 | NA | 4,708 | 1,700.6 | NA |
| 1963 | 34,056 | 2,273.0 | NA | 5,184 | 1,958.7 | NA |
| 1965 | 40,171 | 2,594.4 | NA | 5,709 | 2,284.7 | NA |
| 1967 | 47,137 | 3,049.7 | NA | 6,242 | 2,730.2 | NA |
| 1969 | 54,184 | 3,699.9 | 7,148[a] | 7,148[a] | 3,380.9[a] | NA |
| 1975 | 95,047 | NA | 9,133 | 9,133 | NA | NA |
| 1980 | 142,516 | NA | NA | NA | NA | NA |
| 1984 | 193,829 | NA | NA | NA | NA | NA |

NOTE: The 1950 value for Weisbrod is the gross male human capital stock discounted at a rate of 10 percent. The value is $2,752 using a 4 percent discount rate. For net male human capital stock, the values are $1,055 and $2,218 at 10 and 4 percent discount rates, respectively.

[a] The 1969 value for Graham and Webb and for Eisner depends on the 7.5 percent discount rate used. The value is $14,395 using a 2.5 discount rate, and $2,910 using a 20 percent rate.

[b] Gross capital stock from Table 5.38 and net capital stock from Table 5.39.

each education group. These profiles were then adjusted for expected real growth.[25] As a final step, they used these trajectories to compute the life-expectancy-adjusted, discounted present value of lifetime earnings (using a 7.5 percent discount rate) for each schooling group.[26] The discounted lifetime value was then summed over individuals.

This procedure yielded their estimate of the national stock of male human capital. For 1969, this value was estimated to be $7,148 billion (1969 dollars), nearly double that estimated by Kendrick (see Table 4.1), whose estimate covered the entire adult population.[27]

### Robert Eisner

Robert Eisner (1980) presented a full set of national income and product accounts. In his accounts, Eisner included time series estimates of male human capital derived from the Graham and Webb study. Eisner adjusted the 1969 estimates presented by Graham and Webb backward to 1947 and forward to 1975 on the basis of reported changes in real gross earnings and population.

In addition to using Graham and Webb's "present value estimates of male human capital," for an estimate of gross human capital, Eisner "utilized the Kendrick series on human capital formation" to produce replacement cost estimates of net stocks of human capital (p. 193).[28] Eisner did little to modify either the Graham and Webb or Kendrick model, but the different discount and depreciation rates are of some interest. The similarity between the Eisner gross capital stock and the Graham–Webb estimates can be seen in Table 4.1.

### Dale Jorgenson and Barbara Fraumeni

The most comprehensive effort to develop an estimate of the value of human capital in the United States is that of Jorgenson and Fraumeni (1989). Like Eisner, their estimates are a part of an effort to develop a new system of national accounts for the U.S. economy. Jorgenson and Fraumeni used the gross human capital framework of Mincer and Becker–Chiswick, and adopted many of the assumptions and procedures used by Graham and Webb. Again, we present a brief description of the procedures and data on which their estimates rest.

In the Jorgenson and Fraumeni framework, aggregate human capital is the present discounted value of full lifetime labor income summed over all individuals in the nation. The authors undertook a detailed and rigorous process to obtain this value. For each individual, the present discounted value of full lifetime labor income is the discounted sum of future expected labor-market income plus the discounted sum of future expected "compensation" for nonmarket leisure and nonmarket productive activities, plus the discounted sum of the value of time spent in schooling.[29] Note that the addition of nonmarket "compensation" to market compensation is a significant advance, as is the use of market compensation as opposed to market earnings.

Estimation of these values begins with a comprehensive data set describing the labor-market activities of all citizens. From this data set, an average hourly labor compensation figure is derived for each of 2,196 cells of individuals defined by gender, age (61 categories), and education (18 categories). For each individual in a cell, this average hourly labor compensation figure is multiplied by an estimate of the average hours allocated to market work to obtain annual values of labor market compensation. These values are adjusted for marginal tax rates to obtain annual values of labor-market income. Jorgenson and Fraumeni assumed that the expected income of an individual (of a given sex and education level) in a future period is equal to the current actual income of a similar individual whose age equals the age the original individual will be in that future time period, adjusted for 2 percent annual real income growth. The hourly compensation figure is also multiplied by hours spent in leisure and nonmarket productive activities to obtain nonmarket labor compensation and the "compensation" received for time spent in schooling.[30]

The resulting annual values of market and nonmarket income are then adjusted for depreciation (the change [decrease] in lifetime labor incomes as individuals age, plus the lifetime incomes of those in the population who die or emigrate) and revaluation (the adjustment of the lifetime incomes for individuals in the population with changing prices over time). The sum of these adjusted values is the annual value of full labor income (market and nonmarket) for an individual. Jorgenson and Fraumeni then obtained the present value of lifetime full labor income by discounting the annual streams at a 4 percent real interest rate, accounting for survival probabilities.

The approach adopted by Jorgenson and Fraumeni is based on the Becker–Chiswick human capital concept, makes reasonable (though not universally accepted) assumptions regarding the full value of productive activity generated by human capital, and rests on detailed individual records describing the characteristics of both male and female adults. It stands as the most thorough and comprehensive estimate of national human capital that has yet been developed. The complexity of the model on which the estimates are based, together with the large number of adjustments based on assumed values, makes annual estimation of national human capital on a timely basis impossible.

Because of the more comprehensive approach adopted by Jorgenson and Fraumeni—in particular, the attribution of a return on available nonmaintenance hours spent in home production and leisure—their estimates of the value of the U.S. human capital stock are substantially larger than those of earlier studies. These differences are reflected in Table 4.1.

## ALTERNATIVE ESTIMATES OF THE U.S. HUMAN CAPITAL STOCK

All of the studies discussed in the previous section provided estimates of either the value of private national human wealth or the human wealth embodied in the adult male population. We summarize their findings for selected years in Table 4.1, which is, in part, taken from Jorgenson and Fraumeni (1989). The most striking feature of this table is the sizable differences among the studies in the estimates of human capital.

Some of these differences are due to differences in procedures that are easily understood. For example, part of the difference between the estimates of Jorgenson and Fraumeni and those of Kendrick is due to the fact that the latter estimates are derived from the costs of human capital investment, rather than the expected returns on these estimates. Moreover, Jorgenson and Fraumeni based their estimate on full expected lifetime incomes—including the value of nonmarket activities. All hours of time save those necessary for maintenance have a value that is based on market compensation. Hence, Kendrick's lower estimate is in part due to his neglect of the market and nonmarket returns on schooling. Moreover, his procedures also neglect the growth in the population over time. Finally, while Kendrick relied on a cost index for education and child-rearing, Jorgenson and Fraumeni used an index of lifetime incomes of all individuals related to their schooling.

Related to this, the large estimate of Graham and Webb relative to that of Kendrick is attributable to an (acknowledged) upward bias in Graham and Webb's estimate of the "expected growth in future earnings," their use of pre-tax earnings instead of after-tax earnings (which again results in higher estimates), a downward bias in Kendrick's esti-

mates due to an overstatement in the rate of depreciation that he used, and an understatement of the period of depreciation (Graham and Webb 1979, p. 222). On the other hand, the estimate of Graham and Webb is for the male population of adults, while that of Kendrick is for the entire population.

Finally, the effect of the nonmarket component of labor income on which the Jorgenson and Fraumeni full human capital estimate rests should not be overlooked. For example, Jorgenson and Fraumeni estimated that 84 percent of "total labor income" was attributable to nonmarket labor income in 1975 (Jorgenson and Fraumeni 1989, p. 250). If Jorgenson and Fraumeni's 1969 human capital estimate ($54.2 trillion) is multiplied by 0.15 to obtain an estimate of the level of human capital attributable to expected lifetime market income, the resulting value of $8.1 trillion more closely approximates that of Graham and Webb (and Eisner). Again, however, note that the Graham and Webb estimate is only for the male population.

It should be noted that the empirical estimates of human capital described in Table 4.1 are based on a more limited human capital framework than the full concept of human capital described in Table 3.1. At one extreme, some analysts (e.g., Graham and Webb and Eisner) have thought of an individual's human capital as simply the present value of the trajectory of market earnings, which is but one component of the value of total market production described in Chapter 3. Moreover, market production is only one of the several components of the set of items that compose the full value of the contribution of human capital to gross annual output. As our ledger presented in Table 3.1 stresses, market production, when measured by market wage rates neglects the contribution of human capital to home production, volunteer and leisure activities, consumer surplus, and external benefits. While Jorgenson and Fraumeni provided the most complete estimates of gross human capital, they also neglected important components of the gross value of annual output of human capital, including the value of consumer surplus and the external benefit components of the left side of Table 3.1.

The quite different, cost-based approach of Kendrick seeks to aggregate the costs that have been devoted to the development of an individual's knowledge and skill, and treating these costs as equal to the value of the output of the individual. We have critiqued this

approach above. In addition to neglecting the productive returns on human capital, this approach also neglects the external effects associated with the production of human capital.

## Notes

1. In addition to the papers we discuss in this chapter, a wide variety of other early studies of the investment in and levels of human capital should be noted. These include Ben-Porath (1967), Haley (1973), and Lillard (1975). Many of the earliest contributions are reviewed in Kiker (1971). Comprehensive reviews of the human capital literature include Blaug (1976), Rosen (1977), Sahota (1978), and Willis (1986).
2. In addition to basic ability, schooling/training, and experience, Mincer's framework also allowed for "chance" or "luck."
3. In his 1958 article, Mincer stated the following: "When training is viewed as a process of capital formation in people, three major empirical questions may be raised for economic analysis. (1) How large is the allocation of resources to the training process? (2) What is the rate of return on this form of investment? (3) How useful is knowledge about such investments in explaining particular features of labor force behavior?" (p. 50).
4. See Mincer (1958, p. 285) for the basis of this discussion.
5. While all of these insights are relevant for measuring the stock of human capital, Mincer produced no measures of this stock.
6. He noted that the distribution of the logarithm of earnings may be symmetrical, even though the actual earnings distribution is not, and that applying a "random shock" to the logarithms of earnings will yield a log-normal distribution.
7. Mincer also suggested that relative earnings dispersion is due not to an additive constant, but to a multiplicative constant. Hence, the relative earnings differences between, for example, persons with 10 years and 8 years of training may be larger than those between individuals with 4 and 2 years of training.
8. While this is the definition used throughout his paper, Weisbrod is very conscious about the concept and the definition: "If we are to discuss the 'value' of a person, we must clarify terms. 'Value' of a person in what sense? 'Value' to whom? . . . Next we must decide: Capital value to whom? If our interest is in a person's value to 'society,' this only changes the question we must answer to, How is 'society' defined?" (p. 426).
9. See Weisbrod (1961, p. 427) for the basis of this discussion.
10. In Weisbrod's formulation, the costs of the individual's training are implicitly included in $FC_n$ and $TMC_n$; the benefits of training are reflected in the level of earnings.
11. Weisbrod indicated that this measure of human capital depended on "(1) the value of output of employed persons during each year of age, (2) labor force participation rates by age, and (3) the probabilities of surviving to each age" (p. 427). The

assumption that a person's human capital stock depends on her tastes for income relative to leisure seems questionable. In Chapter 5, we define the EC human capital indicator on which our empirical estimates depend. This human capital indicator reflects the *potential* productivity of individuals, rather than the productivity actually realized.

12. Given this framework and estimation procedure, had Weisbrod estimated the aggregate value of national male human capital in the years after 1950, his estimates would have shown a strong upward trend, reflecting increases in average levels of schooling, wage rates, and productivity over time.
13. Weisbrod relied on the Study of Consumer Expenditure, Income, and Savings for his estimates of resource use. However, the survey included only a small selection of the total set of resources discussed in Chapter 3. He measured human capital using age cohorts based on the age of heads of families. Finally, as with Mincer, the value of fringe benefits is excluded from the concept of earnings (see Weisbrod 1961, p. 429).
14. The basic model of human wealth maximization through investment in human capital was first formulated by Ben-Porath (1967) (see also Haley 1973; Rosen 1973; and Lillard 1975, 1977). In this framework, individuals choose optimal amounts of schooling spread optimally across the lifetime so as to maximize discounted earnings, given their endowments, constraints, and abilities. These individual decisions then determine a lifetime pattern of earnings with the greatest present value. Other individual choices (e.g., consumption and work effort) are then made so as to maximize utility subject to this wealth constraint. Interestingly, it is actual earnings, an endogenous value, that are taken as the maximand, rather than the exogenous concept of potential earnings.
15. See Becker and Chiswick (1966, p. 359) for the basis of this discussion.
16. Empirically, they noted that this equilibrium level of human capital could display "sizable dispersions [among people] in rates of return and amounts invested, and a strong positive relation between them" (p. 362).
17. Johnson estimated earnings capacity for males, distinguished by race-region-education cohorts. Like Weisbrod, Johnson relied on observations of schooling and earnings to estimate earnings capacity. Hence, like Weisbrod, his earnings capacity estimates reflect individual work–leisure choices, rather than a level of potential earnings that abstracts from these choices. For technical reasons, Johnson drew on statistics from other studies, in addition to his own data, to form his human capital estimates. He therefore warned that his estimates are not reliable; hence, we do not discuss them here.
18. This literature has been comprehensively reviewed in Blaug (1976), Rosen (1977), Sahota (1978), and Willis (1986). See also Ashenfelter and Card (1999).
19. Graham and Webb (1979) characterized Kendrick's cost approach as follows: "According to this cost approach, the value of human capital embodied in an individual is the sum of parental-financed rearing costs, and all past direct expenditures on schooling and formal training as well as the sizeable opportunity costs of students and trainees" (p. 211).



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20. Implicitly, Kendrick assumed that human capital is embodied in individuals above the normal retirement age; adjustments for nonwork time are then made in estimating the utilization of human capital.
21. Kendrick's estimate of this component of costs (the direct costs of the firm plus worker's compensation during nonwork/training time) differed from the more comprehensive and conceptually superior approach of Mincer (1962), who argued that the value of on-the-job training is reflected in earnings differences associated with varying levels of training, consistent with his human capital approach.
22. Business sector costs are taken to be equal to one-half of all outlays for health/safety; personal and government sector investment costs for health/safety are based on data from vital health statistics.
23. Note that these estimates assume that the proportion of the nation's human capital that is utilized in each age category equals the overall employment–population ratio for that category. This assumption deviates from the private domestic economy capacity utilization standard that he adopts.
24. See the discussion of Jorgenson and Fraumeni, below, for a different utilization estimation procedure.
25. Their estimate is based on real, growth-adjusted, cross-sectional data from the 15 percent sample of the 1970 Census. They worked with the male population, aged 14–75 and broken into age and education groups. The growth factors used were education-specific annual rates of growth of constant dollar incomes for the 1949–1969 period, obtained from Census data and applied to each education category. "The basic notion is that an individual of age $t$ with a certain vector of identifying characteristics (perhaps sex, age, education, occupation, ability . . .) will base his expectation of earnings $n$ years from now on the observed earnings of people $t + n$ years old now who share his basic characteristics" (Graham and Webb 1979, p. 212).
26. This discount rate was justified as the average of the real rate of return on private savings (4 percent) and the real rate paid on private borrowing (15 percent), with an adjustment for inflation (–2 percent). They also presented results for discount rates of 2.5, 5.0, 10.0, 15.0, and 20.0 percent.
27. Lillard (1977) presented an estimate of mean human wealth based on longitudinal earnings data for a group of 4,699 males born between 1917 and 1925. The males were volunteers for the Air Force pilot and related programs, at least high school graduates, and in the top half of the Armed Forces Qualifying Test (AFQT) examination of ability. The Becker–Chiswick lifetime earnings concept of human capital was employed. He reported a mean estimate of $260,000 of human capital at age 16 in 1970 dollars for the average Protestant male assumed to retire at age 66. This value cannot be used as the basis for an estimate of the value of national human capital, as it is for a particular cohort of selected males.
28. These estimates used a straight-line depreciation formulation as opposed to Kendrick's declining-balance depreciation formulation. See Eisner (1980), footnote on Table 5.39: "Underlying data and assumptions from John W. Kendrick, *The*

*Formation of Stocks of Total Capital*; depreciation, net investment and net capital stock recalculated with straight-line depreciation" (p. 263).

29. Time available to individuals is classified into four categories: work, schooling, household production and leisure, and maintenance (e.g., eating and sleeping). The time spent in formal schooling ($S$) is assumed to be 1,300 hours per year per individual enrolled in school and is considered to be an investment. Work time for the relevant categories is taken from their detailed data set. Time not spent in schooling or work ($W$) is considered consumption ($C$) and is estimated as $C = (14 \text{ hours} \times 365 \text{ days}) - (S + W)$, where 14 hours is assumed to be the time available for all market and nonmarket activities. Imputed compensation for the time devoted to these nonmarket activities is based on hourly market compensation adjusted for marginal tax rates. The authors distinguished among three stages of the life cycle. "For individuals in the third stage of the life cycle, total labor compensation is the sum of compensation for market labor activities after taxes and imputed compensation for nonmarket labor activities. For individuals in the second stage of the life cycle, total labor compensation also includes imputed labor compensation for schooling. For individuals in the first stage of the life cycle, labor compensation includes only the imputed value of time spent in schooling."
30. The Jorgenson and Fraumeni framework for estimating the labor compensation component of human capital can be characterized more formally as follows. People allocate their time between work ($W$), schooling ($S$), household production and leisure ($HHL$), and maintenance ($M$) (e.g., eating and sleeping):

(1) $(24 \text{ hours} \times 365 \text{ days}) = 8{,}760 \text{ hours} = W + S + HHL + M,$

where $M$ is assumed to be 3,650 hours. Thus, $8{,}760 \text{ hours} = W + S + HHL + 3{,}650$ hours, which means that $5{,}110 \text{ hours} = W + S + HHL$.
From this it follows that:

(2) $W = 5{,}110 - (S + HHL).$

If schooling ($S$) is ignored (as for individuals in the third stage of the life cycle), the work/leisure trade-off on which the market time allocation is based is:

(3) $W = 5{,}110 - HHL.$

From Equation (3), Jorgenson and Fraumeni calculated the returns to human wealth ($RHW$) by summing the returns to work (hours worked multiplied by the wage rate) and foregone earnings (hours spent *not* working multiplied by the wage rate):

(4) $RWH = (W \times w) + [(HHL) \times w]$, where $w$ = wage rate.

Hence,

(5) $RWH = (W \times w) + [(5{,}110 - W) \times w] = 5{,}110 \times w$.

This formulation is related to the EC measure that we employ. While Jorgenson and Fraumeni valued all available nonmaintenance hours (5,110) by the relevant wage rate, we use a norm of 2,080 hours taken to be the full utilization norm for the use of human capital in market work.

# 5
# Earnings Capacity as an Indicator of Human Capital

In this chapter, we define our indicator of human capital. Earnings capacity is not an estimate of the asset value of the human capital stock; rather, it is an estimator of the potential annual rental value of that stock. However, under reasonable assumptions about the evolution of population demographics over time, EC is a good indicator, or "tracker" of the aggregate human capital stock. We first define our EC concept; then we describe the assumptions and judgements on which the EC concept rests and indicate the empirical procedures that we use in estimating this value. In subsequent chapters, we employ our estimates of EC to study the level and trend of human capital over the 1975–2000 period for the working-age population and subgroups of it. We also study the extent to which human capital in the United States has been utilized over this period.

## THE EC CONCEPT: ASSUMPTIONS AND NORMS

The EC of an individual is defined as the "potential" earned income that he or she could generate in a year, given his or her human capital characteristics. Individuals with human capital characteristics which are positively related to market productivity—for example, those who are of prime working age and have high levels of schooling—will have higher EC values than those whose characteristics imply lower levels of market productivity. Having an EC value for individuals allows us to calculate the value of potential human capital services of socioeconomic groups or of the nation; group or national estimates of EC are obtained by aggregating the EC of their constituent members. As an annual measure, EC can be thought of as an estimate of the *potential annual rental income of human capital.*

The meaning of the term "potential" is fundamental to the EC concept. While prior estimates of the "asset value" of human capital rest on actual levels of observed earnings of individuals,[1] we argue that actual earnings are endogenous to individual tastes and opportunities and, hence, should not serve as the basis for assessing the value of human capital resources. Indeed, adopting this assumption implies the dependence of the nation's human capital stock on individual labor supply choices. Rather, we adopt the framework for assessing the value of physical capital (e.g., a machine or a vehicle) as described in Chapter 2. The capacity—or potential—level of services of the unit of physical capital is determined, and then the asset is valued using the prices that these services earn in the market. This approach allows comparisons between the potential and actual utilization of capital. By valuing human capital in an analogous way, we are able to calculate a rate of human capital utilization similar to that reported for physical capital.

In proceeding this way, a central question is: What level of engagement in productive activities should be taken as the norm for the "capacity" or potential level of human capital services? Although somewhat arbitrary, we accept a full-time, full-year (FTFY) work norm as that potential level. The earnings associated with that level of work is the individual's EC. We rely on the earnings of those people who are employed FTFY to estimate the EC of all working-age individuals. For our purposes, the set of all working age individuals embodies the nation's human capital.[2] Aggregate EC, the potential annual rental income of human capital in the United States, is the level of earnings that would be realized if all working age individuals were to work at the FTFY norm at wage rates consistent with their human capital characteristics.[3]

Given the emphasis in Chapter 3 on defining a comprehensive measure of human capital, a second question about the EC concept concerns the extent to which the annual EC indicator conforms to the full human capital concept. First, EC does not reflect the resource utilization (social costs) associated with the employment of human capital. It is a gross rather than a net concept, and the items on the right side of Table 3.1 are not included in its calculation. In this sense, EC is a measure of the value of gross annual product summarized on the left side of

that table. It is analogous to the annual rental value of a unit of physical capital, such as a vehicle, machine, or factory.

Next, note that while EC reflects the value of potential (FTFY) human capital services appraised at their market value,[4] it fails to capture several components of the value of gross annual product that do not pass through a market. For example, the value of human capital outputs beyond market activities—leisure activities, home production, and volunteer activities (LA, HP, and VA in Table 3.1) are only partly captured. Individuals who work less than FTFY must have allocated time to some or all of these nonmarketed activities. Since EC is valued at the FTFY level, we essentially value these nonmarket hours at the individual's estimated FTFY market wage rate, just as discussed in Chapter 3.[5] However, EC does not include the value of human capital use beyond the potential utilization norm. As such, all hours devoted to home production, volunteer activities, and leisure activities (as well as market production) in excess of that norm are excluded. Finally, EC captures neither the consumer surplus nor the external benefits associated with the use of human capital.

To summarize, EC is a limited estimator of the value of gross annual product, generally capturing a portion of market production (excluding fringe benefits), home production, volunteer activities, and leisure activities.

Recall that our objective is to estimate the value of the capacity (FTFY) market activities of individuals and that we rely on the observed wage structure in the labor market for this valuation. Thus, a third basic question arises. What implicit assumptions regarding the operation of the market underlie the EC indicator?

The most basic assumption is that labor markets are competitive and free of distortions, such that observed wage rates are equal (at the margin) to the market value of the work activities (in terms of number of workers or hours worked) of people who possess human capital.[6] However, our assumptions go further than this. By using a structure of wage rates in a given year which reflects actual labor supplies and demands in that year, we implicitly assume that the wage structure is invariant to the implied shifts in labor supply associated with a move from actual to capacity market work levels. This is equivalent to assuming perfectly elastic, short-run labor demand schedules for various types of workers or various forms of human capital. With this

assumption, our EC indicator reflects what the value of human capital would be if workers engaged in capacity (FTFY) market work at the existing structure of wage rates applicable to such employment.

By using the observed structure of wages in each year to estimate the rental value of potential human capital in that year, our estimated EC trends incorporate the effects of intertemporal changes in the relative demands and supplies of various types of workers and forms of human capital (which result in changes in relative wage rates). This procedure is quite consistent with that adopted in measuring a time series of the "asset value" of the human capital stock. Indeed, the discounted present value of the future stream of activities of a person at a point in time requires some assumption regarding the future value of those activities, which in the case of marketed activities implies the structure of wages over time. Estimates of this stock over time will, therefore, reflect intertemporal changes in the structure of wages, as will estimates of the trend in EC.

Given these procedures, will estimates of our EC indicator over time reflect changes in true, but unmeasured, human capital values consistent with the framework of Table 3.1? In addition to the assumptions already stated, a few additional conditions are necessary for this conformance to hold. First, the quantitative magnitude of the several deviations of the EC concept from the full framework of Table 3.1 must remain constant over time. For example, the relationship between the external benefits associated with the use of human capital and the value of the full potential use of human capital as valued by the market must remain fixed if the EC indicator is to accurately track the asset value of the human capital stock.

Second, if EC is to accurately track the true value of the human capital stock over time, the relationship between the current and future structure of implicit prices of human capital characteristics must remain constant over time. This condition is necessary because the annual value of EC reflects a point-in-time distribution of implicit prices attached to the human capital characteristics of the population (e.g., schooling levels or the age distribution), while the asset value of human capital reflects the future (but unknown) trajectory of these implicit prices over time. Because the time series of the true asset value of the human capital stock also reflects the interest rate used to obtain the present value of future expected streams, this price of "waiting"

must also remain constant if the EC series is to be an accurate indicator of the trajectory of the true human capital stock.

Finally, whereas a reliable time series of the asset value of the human capital stock reflects temporal changes in expected remaining years of life of the existing population, our EC measure does not. To the extent that life expectancies increase over time, the time trajectory of the EC indicator will indicate lower growth in human capital than will a comprehensive and accurate measure of the value of the human capital stock.[7]

## WHY THE EC INDICATOR OF HUMAN CAPITAL?

Although the EC indicator rests on several assumptions and judgements, it has a number of practical and conceptual advantages relative to alternative procedures for assessing the nation's human capital stock. As indicated in Chapter 4, a variety of estimates of the "asset value" of the nation's human capital stock at a point in time are available.[8] All of these estimates—especially the more comprehensive ones, such as those presented by Jorgenson and Fraumeni (1989)—are based on complex calculating algorithms and have extensive data requirements. Many of the required data inputs are publicly available only intermittently or with substantial time lags. Hence, timely estimates of the nation's human capital stock based on these measures are not possible. While the EC human capital indicator is less comprehensive than some of these alternatives (though arguably more consistent with the conceptual basis of human capital discussed in Chapter 3), it can be estimated and presented on a timely basis. Indeed, EC estimates rest on annual public use data files available from the Census Bureau within several months following the end of each calendar year.

Moreover, while alternative "asset value" measures have been presented only for the entire population of the nation, the EC indicator is also available on a timely basis for numerous subgroups of the national population, such as age, race, gender, and education groupings. In estimates presented below, we show EC measures for these demographic groupings, as well as for more specific population groups of special

interest. Further, the EC human capital indicator can be used as the basis for timely estimates of human capital utilization, unlike the alternative asset value measures. These utilization estimates are analogous to the regularly published indicators of the utilization of physical capital, as described in Chapter 2. Moreover, while available measures of physical capital utilization reveal overall temporal patterns in capital use, the EC human capital indicator is able to distinguish the sources of nonutilization, as we show below.

Finally, as we have indicated in Chapter 1, the familiar statistical indicators of labor market performance measure either the physical quantity of potential and actual labor services (e.g., the labor force, employment, unemployment, or hours worked) or the price of labor services (e.g., wage rates). Our EC indicator, however, captures both the level of potential labor supply and the valuation of these services. For many questions, then, the EC measure is able to provide a richer and more comprehensive description of the actual and potential performance of the labor market than can these more commonly used indicators.

## THE MEASUREMENT OF EC: A SUMMARY DESCRIPTION

In measuring EC, we apply commonly accepted social norms and value the skills and knowledge capabilities of only those people who are expected to use them in market activities. For this reason, we exclude children, youths, and the elderly from our estimation, and we measure the earnings capacities of men and women aged 18–64 years.

Second, as discussed above, we look to the labor market for clues regarding the value of the productive capabilities of working-age people. In our procedure, the market earnings of FTFY employed working-age people serve as the basis for estimating the value of the human capital embodied in all working-age people. In essence, we attribute the mean earnings of FTFY workers with any particular set of human capital characteristics (such as education, age, race, and so on) to each working-age person (whether a FTFY worker or not) with the same set of characteristics. This mean value is taken to be the individual's EC,

the annual amount that he or she would earn if he or she worked at capacity.

Referring to the framework of Chapter 3, EC equals the FTFY hours devoted to any of the productive activities of market work (*MP*), home production (*HP*), volunteer activities (*VA*), and leisure (*LA*), all valued by the person's FTFY market wage rate. That is:

$$EC = (\textit{FTFY hours allocated to MP, HP, VA, and LA}) \times W_{FT},$$

where $W_{FT}$ is the person's wage rate at FTFY work. If, in fact, the person works FTFY, $EC = MP \times W_{FT}$.[9]

Thus far, the statistical procedure that we use assigns the same EC value to all individuals with a given set of human capital characteristics. As such, a host of factors that are not reflected in the statistical model are ignored. These factors include individual characteristics that are related to human capital, but which we do not observe and which therefore cannot be included in our model. A person's motivation or drive would be an example. They also include unmeasured labor demand characteristics and "luck." As a result, the predicted EC values that we obtain from the model have an arbitrarily narrowed—or pinched—distribution. To adjust for this, we adopt a procedure that restores the effect of these unobserved factors. As we describe more formally below, we apply a random shock reflecting the unexplained variation in the regressions to the estimated value for each observation. While this procedure requires a number of assumptions regarding the distribution of the unobserved factors, it is a reasonable way to secure a distribution of EC values, one for each working-age person aged 18–64 years, that avoids this arbitrary narrowing of the distribution.

In sum, then, our individual EC estimates reflect what each relevant working-age individual would earn if he or she held a FTFY job paying a wage commensurate with his or her observed human capital characteristics.

## THE MEASUREMENT OF INDIVIDUAL EC: A MORE FORMAL STATEMENT

Define each adult's earning capacity ($EC_i$) as the earnings that the person would receive if he or she were to work FTFY at a wage rate consistent with his or her human capital characteristics. Our goal is to estimate $EC_i$ for a large representative sample of working age individuals.[10] We rely on a two-equation model fit to four race- and gender-(white–nonwhite, male–female) specific samples of civilian, non-self-employed, nonstudent adults aged 18–64, drawn from the March CPS for 1976 through 2001.[11]

In the first equation, the annual correlates of the FTFY labor-force participation status of adults of each race–gender category are estimated using a probit specification. The independent variables include factors that affect an individual's expected market wage (e.g., health status, education, and age), recognizing that such an individual has a reservation wage, below which he or she will not work at all or not work full time. This set of variables also includes characteristics that affect the individual's incentive to work (e.g., nonlabor income, marital status, and presence and number of children) and indicators that characterize the labor market in which he or she seeks employment (e.g., the state unemployment rate, region of the country, and rural-suburban-urban location).

Estimates from the first-stage equations are used to construct a selectivity correction term ($\lambda$) for each individual. These terms are used in annual, group-specific, second-stage earnings equations fit over the subsample of individuals who are FTFY workers. This additional regressor addresses the bias that would otherwise result from fitting an earnings equation only over individuals who self-select into the FTFY labor force.[12]

The second-stage earnings equation is of the form:

$$(1) \quad \ln(Y_i) = X_i\beta + \gamma\lambda_i + \epsilon_i \quad ,$$

where $Y_i$ is the observed earnings of individual $i$, a FTFY worker, $X_i$ is composed of the characteristics of that individual that affect his or her earnings, $\lambda_i$ is the selectivity correction term, and $\epsilon_i$ is an unobserved

residual term, which we assume to be randomly distributed $N(0,\sigma^2)$. The elements of the $X$ vector were chosen using the human capital model as a guide, and they include education, age, region of the country, rural-suburban-urban location, marital status, number of children and their ages, and a health status indicator. We estimate this FTFY earnings model separately for the four race–gender groups. The estimates conform to the predictions from the human capital model discussed in Chapters 3 and 4: earnings are an increasing function of education and age, and whites and men have higher earnings than nonwhites and women. Changes in the estimated coefficients over the years reflect intertemporal changes in labor supply, labor demand, and the structure of the labor market.

To obtain the $EC_i$ estimate for each adult, we employ coefficients from the appropriate race–gender earnings Equation 1 and the person's human capital and other market-relevant characteristics. Hence, each individual with the same set of characteristics is assigned the same earnings capacity.

As noted previously, because this procedure neglects the role of unobserved human capital and labor-demand characteristics and "luck" in the earnings determination process, the resulting $EC_i$ distribution for each race–gender group and for the entire population is artificially compressed. Therefore, we return the unexplained earnings variation within each race–gender group to these distributions by applying a random shock (reflecting the unexplained variation in the regressions) to the estimated value for each observation within a race–gender cell.[13] Hence, for each working-age adult:

$$(2) \quad \ln(EC_i) = X_i b + c\lambda_i + \sigma m_i \ ,$$

where $m_i$ is a randomly generated variable distributed $N(0,1)$, $\sigma$ is the estimated standard error from the appropriate regression, $b$ is the vector of estimated coefficients for the characteristics in $X$, and $c$ is the estimated coefficient for the selectivity correction term, $\lambda$. Exponentiating the natural logarithm of $EC$ returns an estimate of the individual's $EC$.

Given these norms and statistical procedures, then, we obtain a measure of the $EC_i$ for each observation in a sample of the population. When the appropriate weights are applied to these estimates, the value

of aggregate EC for the nation's working-age population can be obtained. This result, we emphasize, is simply an indicator—a measure—of capabilities or potential. As such, our measure carries no suggestion that everyone aged 18–64 *should* work FTFY, or that anyone who does not work at this level is somehow a "slacker."

## EARNING CAPACITY IN THE CONTEXT OF THE HUMAN CAPITAL FRAMEWORK

How does our measure of EC compare to the human capital framework of Chapter 3?

First, recall from Table 3.1 and the discussion in Chapter 3 the definition of the net human capital of a nation:

$$NHC = \sum_{i=1}^{I} \sum_{t=1}^{T_i} \frac{VNAP_{it}}{(1+r)^t},$$

where $VNAP_{it}$, the value of the net annual product of person $i$ at time $t$, is defined as:

$$VNAP_{it} = VGAP_{it} - VARU_{it}.$$

(To recall, $VGAP_{it}$ [the value of gross annual product for an individual at a particular time] is $VGAP_{it} = MP_{it} + HP_{it} + VA_{it} + LA_{it} + CS_{it} + EB_{it}$. Similarly, $VARU_{it}$, [the value of annual resource use] is $VARU_{it} = FSC_{it} + TMC_{it} + ET_{it} - PS_{it} + EC_{it}$.)

Second, recall the definition of EC: the amount an individual would earn if he or she worked FTFY (that is, at capacity) at a wage rate consistent with his or her human capital characteristics. Thus EC is essentially an estimate of market production when the individual devotes all of her capacity hours (beyond that required for basic maintenance) to market activities. That is, EC is a measure of the value of gross annual product assuming the individual allocates no time to home production, volunteer activities, or leisure time, and assuming no consumer surplus or external benefits accrue to other members of society. It is a gross measure, neglecting the costs necessary to sustain the activities of individuals. Then, since the aggregate earnings capacity

(AEC) of a population at a point in time is the sum of the EC of its individual members:

$$AEC_t = \sum_{i=1}^{I} EC_{it} = \sum_{i=1}^{I} VGAP_{it} \mid MP_{it} \text{ at capacity} .$$

For those individuals who do not allocate their full efforts to market production, we can estimate the value of their home production, volunteer activities, and leisure activities, provided we have estimates of the amount of time spent in those activities, and we are willing to value those activities at the estimated market wage rate. We present our estimates of EC and the value of EC allocated to nonmarketed activities in Chapter 6. In that chapter, we present EC allocated to nonmarketed activities as *unrealized potential earnings*—dollars of earnings not realized because time is allocated to home production and other nonmarket activities.

How does our aggregate EC measure compare to the most comprehensive of those discussed in Chapter 4, namely that of Jorgenson and Fraumeni (1989)? Jorgenson and Fraumeni began with the assumption that all hours beyond those required for basic maintenance are available for productive (although not necessarily marketed) activities. In contrast, the EC measure values the use of human capital only up to the FTFY capacity norm (see note 3). Jorgenson and Fraumeni, too, assigned the same average wage rate to all individuals with common characteristics and assumed that the value of one hour in a nonmarket activity equals that average wage rate, adjusted for taxes. While they worked with the actual wage rate of individuals, we impute a FTFY wage rate to their capacity hours (see note 9). Jorgenson and Fraumeni then went one step further than we do and made a number of assumptions about the evolution of wages over time. They were then able to discount those potential earnings streams (the value of all hours beyond those required for basic maintenance, like sleeping and eating) back to various points in time in order to obtain a series of present discounted values. These values form the basis of their human capital estimates. In the language of Chapter 3, Jorgenson and Fraumeni estimated a variant of our value of gross annual product concept, and calculated gross human capital for each individual for a particular point

in time; they then summed over individuals to obtain their estimate of the nation's gross human capital ($GHC_{JF}$):

$$GHC_{JF} = \sum_{i=1}^{I} GHC_{JF\,i} = \sum_{i=1}^{I} \sum_{t=1}^{T} \frac{VGAP_{JFit}}{(1+r)^t} .$$

Thus, Jorgenson and Fraumeni measured the stock of human capital existing at a point in time, whereas we measure the potential annual market output attributable to that stock. Both measures require assumptions regarding the evolution of wages over time. The Jorgenson and Fraumeni measure of human capital is sensitive to the interest rate used to discount future earnings to the present. Our EC estimator requires no assumption about interest rates. Finally, our EC estimator can easily provide time series estimates of the return on human capital using repeated cross sections of a population. The Jorgenson and Fraumeni human capital estimator can also provide a time series using repeated cross sections of a population; however, the authors must create lifetime wage profiles for each individual in each repeated cross section.

Until this point, we have attempted to set our EC measure into a broad framework. We presented a series of regularly published aggregate human and physical capital and utilization statistics in Chapter 2. In Chapter 3, we constructed a general human capital framework and reviewed the key literature on the measurement of human capital in Chapter 4. In the present chapter, we reflect on our own indicator of human capital, EC, and argue that the measure is an improvement on existing indicators of human capital. In the following chapters, we turn to the estimation of EC for the entire population and for various subgroups of it. Our estimates are presented in tables and figures with the ultimate objective of providing a more comprehensive view of the level and utilization of human capital in the United States over the past 25 years.

## Notes

1. See the discussion in Chapter 4, especially Jorgenson and Fraumeni (1989) and Lillard (1977).

2. We define the set of working-age individuals as all individuals aged 18–64. Thus, we assume that all productive human capital is contained in this population. This assumption is discussed more fully below.
3. Like Jorgenson and Fraumeni (1989), EC assigns a value to the services associated with the allocation of "available time." However, the two approaches differ in terms of the definition of available time. Jorgenson and Fraumeni assumed that available time equals all of the hours that a person has beyond those necessary for maintenance and presumed that human capital is productively used for all of these hours. Our EC concept accepts a market-based norm for the full utilization of available hours, namely the FTFY work standard.
4. Also note that, because EC relies on the market earnings associated with the capacity use of human capital, it does not reflect the fringe benefits that are reflected in a full compensation package. The data on which we base our estimates do not contain information on full compensation.
5. In other words, if the value of each hour allocated to market and nonmarket activities is equal across all activities, then the actual allocation of those hours is irrelevant. The earned income associated with FTFY (capacity or potential) use of human capital accurately measures the value of the potential use of human capital, whether employed in market or nonmarket activities. See the discussion in Chapter 3.
6. Recall from Chapter 3 that the use of observed wages to value both marginal and the inframarginal work activities, implies that the consumer surplus associated with the inframarginal activities is not captured, nor are the external benefits associated with those activities.
7. In order to test the robustness of EC as an indicator of the aggregate stock of human capital, we conducted simulations using small samples of generated data. We calculated annual values of aggregate EC and compared them to the full value of the stock of human capital over time. We imposed extremely large changes on the demographic composition of the simulated population, on the relative prices attached to sets of human capital characteristics, on changes in these relative prices over time, and on the size, growth rate, and life expectancy of the population. In all cases, the changes imposed were far greater than would be seen in any actual population. The simulations showed the time trend of EC to be a remarkably robust indicator of the trend in aggregate human capital.
8. The estimates for multiple years shown in Table 4.1 are generally the various authors' extrapolations from base estimates and do not reflect current underlying data.
9. Note that the use of the FTFY market wage rate also distinguishes the EC approach from that of Jorgenson and Fraumeni. While they used the market wage rate to predict the value of all nonmarket activities undertaken during those nonmaintenance hours not engaged in market work, EC uses the FTFY wage rate of the individual to value potential or capacity work time.
10. The following description summarizes our procedure; a full description of data and methods is in Appendix A.

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11. The March CPS is an annual survey of over 60,000 American families. It contains detailed information on the income and labor-market activities of the adults in the family. Interviewers also obtain information on the size, composition, and demographic characteristics of the family. It is a stratified random sample, so that using the appropriate weighting factors (provided by the U.S. Bureau of the Census) yields a picture of the economic status and labor-market activities of the entire U.S. population. Each March survey contains data on the previous calendar year. Self-employed individuals are excluded from the data used to estimate the EC model because their reported earnings are likely to be a combination of return on human capital and a return on invested capital. However, their human capital characteristics are no less observable than the characteristics of the non-self-employed. We therefore assign an EC value to these individuals and include them in our EC tabulations. Students, military personnel, and institutionalized individuals are excluded from both the model data and the tabulations.
12. See Heckman (1979).
13. In making this adjustment, we assume that the distribution of FTFY earnings within a race–gender cell is normal, with a standard deviation equal to the standard error of the estimated race–gender earnings equation fit over the FTFY workers. We use the standard error ($\sigma$) from the estimated FTFY equations assuming that, even if everyone worked to capacity, the variance of earnings would be the same as the estimated variance of earnings among FTFY workers. In fact, the earnings residual ($\epsilon$) contains both earnings due to unmeasured individual-specific human capital ($\delta$) and random fluctuations in earnings ($\nu$). That is:

$$\epsilon_{it} = \delta_i + \nu_{it},$$

where $i$ is a subscript for the individual and $t$ is a time subscript. We assume that $\delta$ and $\nu$ are independently and normally distributed with a zero expected value and constant variance; they are also assumed to be independent of each other. With cross-sectional data, it is not possible to distinguish between $\delta_i$ and $\nu_{it}$. If we do not make an adjustment to add back variance, we are implicitly assuming that the entire residual is made up of transitory shocks to earnings (i.e., $\epsilon_{it} = \nu_{it}$). In effect, our method assumes that the entire residual represents permanent differences in individual-specific human capital stock (i.e., $\epsilon_{it} = \delta_i$). See Lillard and Willis (1978) for discussion of the error component structure and some empirical estimates of the transitory and permanent components of the residual term.

# 6
# Aggregate EC, Utilization, and the Sources of Nonuse

## Levels and Trends, 1975–2000

We have defined EC as the annual market rental value of the stock of human capital held by an individual or group and proposed an empirical procedure for estimating EC for individuals and groups in the economy. We have suggested that group-specific estimates of EC are an indicator of the level of human capital possessed by a group, even though EC does not reflect a number of components of a full definition of human capital.

In this chapter, we move from exploring the EC concept as an indicator of the value of the stock of human capital to empirical estimation of this indicator. We present our empirical estimates of the level and trend of EC over the 1975–2000 period. We also explore both aggregate level estimates and those that reflect the level of and changes in human capital per working-age individual. We then present estimates of both the aggregate and average utilization of human capital among several socioeconomic groups and measure the contribution of various reasons for not using human capital to the aggregate value of unrealized EC. Both the level and composition of unutilized human capital are also described over the 1975–2000 period. The series of figures and tables included in the chapter describe these human capital patterns over the 1975–2000 period for the entire working-age population. All dollar amounts are in 2000 dollars.

### THE NATION'S TOTAL EC: 1975–2000

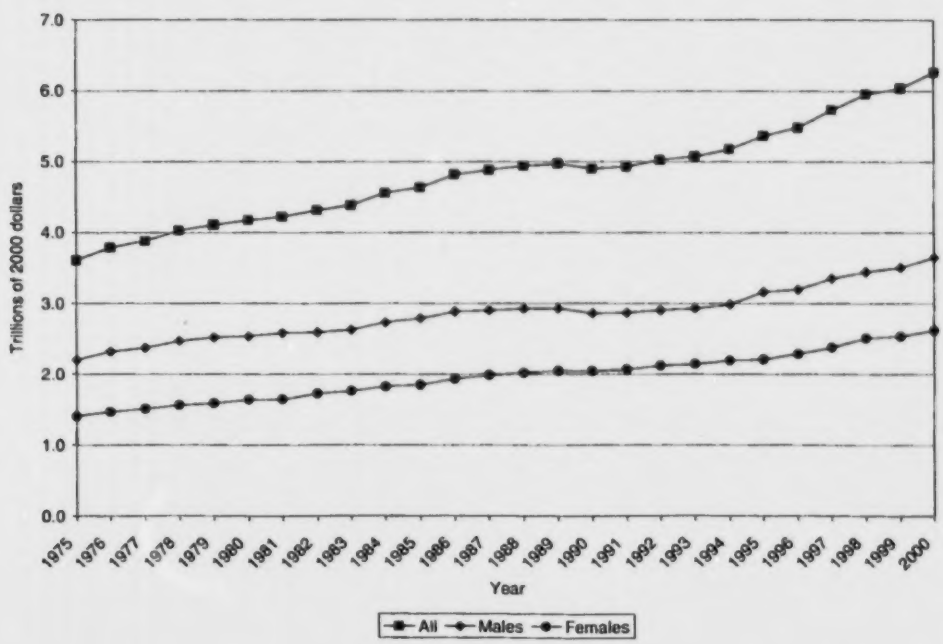
Consider, first, the aggregate level of EC for the entire working-age population. While the EC concept reflects the annual rental value

of the existing stock of human capital, it should be interpreted with caution as it does not capture the full social value of the nation's human capital stock.[1]

Figure 6.1 presents the aggregate level of EC for the U.S. working-age population from 1975 through 2000, as well as its gender composition. Table 6.1 presents the aggregate EC estimates for the 1975 to 2000 period in tabular form for the total working-age population and for men and women. (Tables B.1 through B.3 in Appendix B present detailed estimates of the levels of aggregate EC for age, race, and schooling groups along with the percentage change in total earnings capacity for each of the groups over the period from 1975 to 2000.)

Over the 26-year period from 1975 to 2000, the level of the nation's aggregate EC rose from $3.6 trillion to $6.3 trillion, an increase of 74 percent. By comparison, the total earnings of the working-age population increased from $2.2 trillion to $4.5 trillion; an increase of 103 percent. That actual earnings increased faster than EC suggests an increase in the utilization of the nation's human capital

**Figure 6.1 Aggregate EC, Total and by Sex**



stock over this 26-year period. (This point will be explored further in the next section.)

These aggregate EC levels can also be compared to the level and growth of the nation's real GDP. Real GDP increased from $4.37 trillion to $9.96 trillion over this period, an increase of 128 percent. Hence, the amount of real final output produced in the economy per dollar of potential human capital services grew from $1.21 to $1.58, or by 30 percent. This increase in output per unit of potential human capital services reflects changes in the productivity of the human capital stock over time, which in turn reflects changes in the age, race, gender, and education composition of the working-age population. It also reflects changes in the extent to which the nation's human capital stock was utilized,[2] as well as changes in the productivity and level of other inputs, such as physical capital, to the production process.[3]

Aggregate EC increased each year from 1975 to 1989, reflecting both the growth of the nation's working-age population and the market's valuation of the productive characteristics of this population.[4] Although recessions tend to erode wage rates, even the severe recession of 1982–1983 did not result in a reduction in the level of aggregate EC. However, a slight decrease in aggregate EC is recorded during the recession of the early 1990s, when the value of aggregate EC did not recover its 1989 level until 1992. The surge in aggregate EC from 1993 to 2000 is noteworthy; over this 7-year period, aggregate EC increased by over 24 percent.

Figure 6.1 also shows the level of aggregate EC attributed to males and females. While male aggregate EC increased from $2.20 trillion to $3.65 trillion (or by 66 percent), aggregate female EC increased from $1.40 trillion to $2.62 trillion (or by 86 percent). As a result, while the male human capital stock accounted for about 61 percent of the nation's aggregate human capital in 1975, males accounted for a smaller 58 percent of the total by 2000. In large part, the relative growth of female wages over this period accounts for this pattern. Over the 26-year period, aggregate female EC increased each year. However, while aggregate male EC grew persistently over the period, its level eroded slightly from 1989 to 1994.

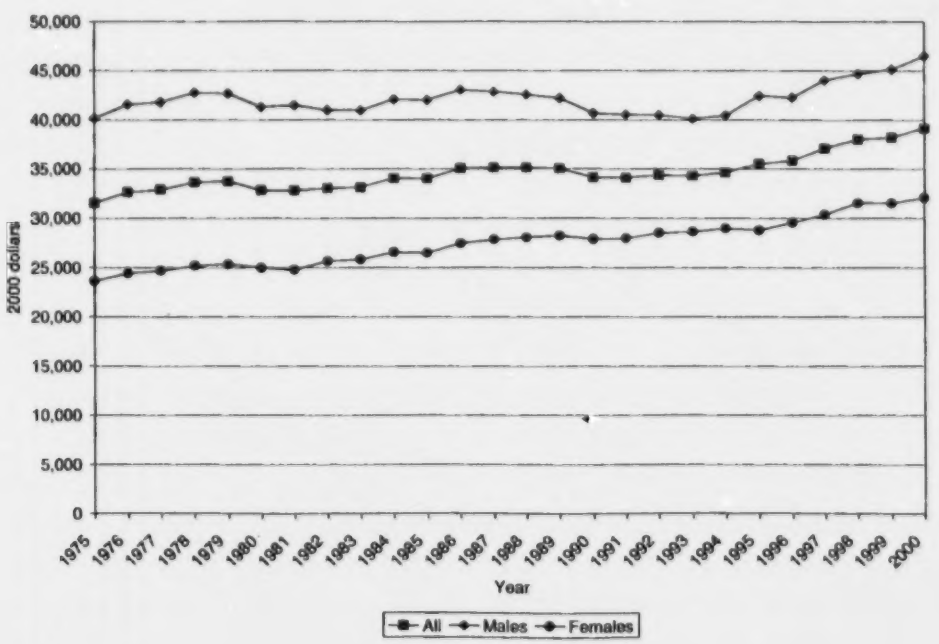
## PER CAPITA EC IN THE UNITED STATES: 1975–2000

While the patterns and growth of aggregate human capital in the United States are interesting in their own right, these total EC figures are the product of the number of working-age people and the average EC embodied in each. Hence, change in the aggregate EC estimates over time reflects changes in the size of the population and its composition, as well as changes in the returns on various characteristics of the working-age population.

In this section, we attempt to disentangle the effects of growth in the size of the population and groups of the population, from changes in the returns on their human capital characteristics. In the following figures, we summarize the levels and trends in the average level of human capital (EC per working-age person) for the entire population and for men and women separately.

Figure 6.2 presents this average human capital value for the entire working-age population and for the male and female components of it. Table 6.2 presents average EC for the 1975–2000 period in tabular

**Figure 6.2 Per Capita EC, Total and by Sex**



form for the entire working-age population and for men and women. (Tables B.5 through B.7 in Appendix B present detailed estimates of the levels of per capita EC for age, race, and schooling groups along with the percentage change in total EC for each of the groups over the period from 1975 to 2000.)

For all working-age adults, average real EC increased from $31,500 to $39,100 from 1975 to 2000, or about 24 percent. Over this same period, per capita real male EC increased by only 16 percent, from $40,100 to $46,500. After edging up from 1975 to 1978, average male EC eroded by about $1,800 during the recession of the early 1980s. While it recovered during the 1980s, it had failed to reach its peak of a decade earlier by 1989. Average male EC again dropped during the recession of the early 1990s, in this case by about $2,500, and fell below its level in 1975. Only since 1993 has average male EC grown steadily, and this 8-year period has accounted for the entire $6,000 increase in average male EC over the entire 26-year period.

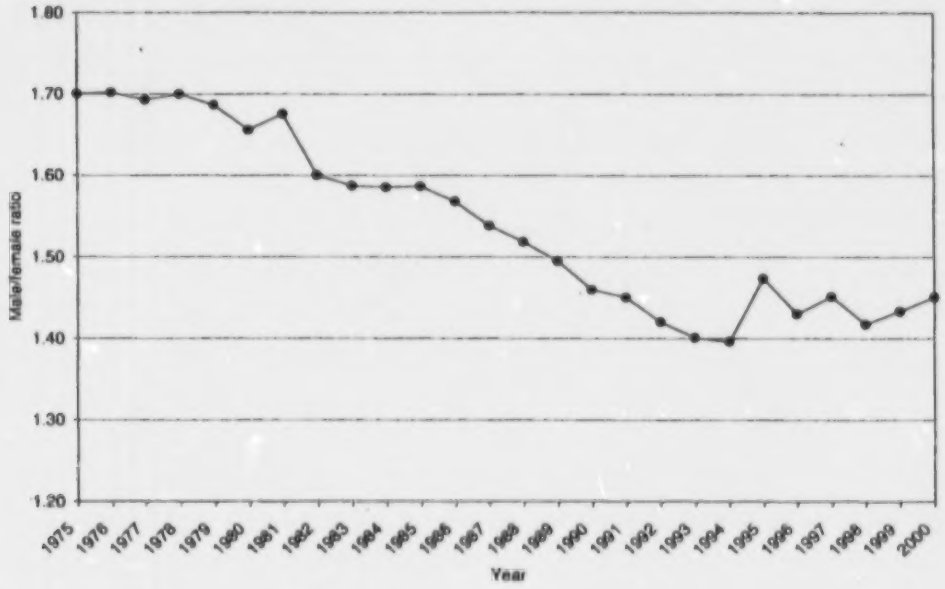
By contrast, per capita female human capital increased over the period from $23,600 to $32,100, or by 36 percent. Growth in average female EC was persistent over the entire 26 years, sagging only slightly during both of the recession periods. This gender disparity in the growth of EC is clearly seen in the convergence of the two time trends over the period.

Figure 6.3 shows the decreasing ratio of male to female EC from 1975 to 1990, followed by stability until 2000. The ratio decreased from 1.70 at the beginning of the period to 1.40 by 1994, or by 18 percent; while there was some fluctuation during the decade of the 1990s, no further trend in the ratio is observed.

## THE UTILIZATION OF THE NATION'S TOTAL EC: 1975–2000

In the first two sections, we presented level and time series estimates of both aggregate and per capita (or average) EC. In this section, we explore patterns in the utilization of human capital (EC) over the past quarter of a century.

**Figure 6.3 Ratio of Male to Female Per Capita EC**




## The Capacity Utilization Concept

We consider people to be utilizing their human capital at capacity if they work at a level commonly accepted to be full utilization—FTFY work—and if they supply their labor to the market at a wage rate consistent with the productivity implied by their characteristics.[5] Stated alternatively, we presume a person's human capital is used at capacity if her actual earnings $E_i$ (her hours worked times her wage rate) are at least as great as her $EC$. Individuals for whom $E_i \geq EC_i$ are considered to be working at capacity; individuals for whom $E_i < EC_i$ are viewed as underutilizing their human capital.[6]

The indicator that we use to measure the extent of human capital utilization is the capacity utilization rate (CUR). For any set of working-age people, $J$, per capita $CUR$ is:

$$CUR_J = \frac{\sum_{i=1}^{I} E_{iJ}}{\sum_{i=1}^{I} EC_{iJ}},$$

where *I* is the total number of individuals in the set *J*. So defined, CUR is interpreted as a ratio indicating the extent to which actual human capital utilization deviates from full capacity use, based on a socially accepted norm of FTFY work.

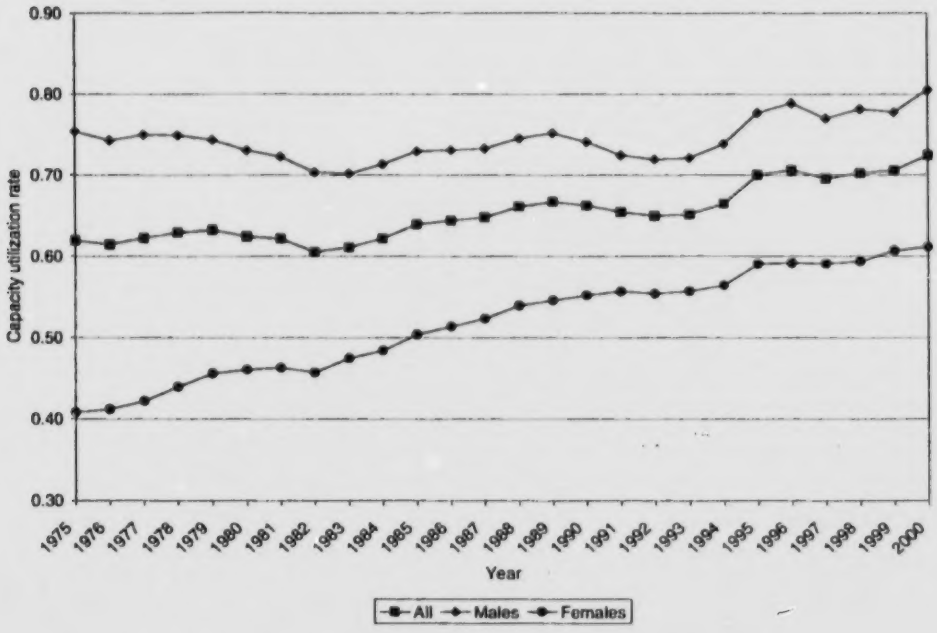
This approach rests on several assumptions regarding the operation of the labor market, the definition of "potential," and the extent to which measured changes in EC track changes in the full social evaluation of human capital. We presume that, at the margin and over the long run, a person's wage rate reflects the value of the marginal product of her human capital services. This presumption holds when labor markets clear in accord with competitive labor-market conditions and full employment exists. It may also hold in the face of a variety of market distortions. For example, if wages are set in accord with efficiency wage considerations or to compensate for increased temporary layoffs, or if they reflect the power of trade unions, a wage rate is a reasonable proxy for the marginal value of productivity.[7] We note that our estimates of both aggregate and per capita EC assume that the structure of wage rates would not change in any important way if all working-age citizens were to increase their annual work time to FTFY status, reflecting the full use of their human capital.[8]

**The CUR of the Working-Age Population**

Table 6.3 and Figure 6.4 show the CUR of the entire working-age population, as well as of working-age males and females. (Tables B.8 and B.9 in Appendix B present detailed estimates of the patterns of capacity utilization for age, race, and schooling groups along with the change in capacity utilization for each of the groups over the period from 1975 to 2000.) As indicated above, the CUR is calculated by summing the earnings of the relevant group and comparing this value to the sum of individual ECs of the members of the group. The ratio of these two values indicates the extent to which groups of working-age citizens utilize their stock of human capital.

The trend in aggregate CUR is erratic, reflecting both changes in wage rates due to changes in the macroeconomic performance of the economy and relative labor demands and secular changes in labor force participation and working-time patterns. The effect of the recession of the early 1980s is seen in the overall CUR, as it fell from over 63 per-

**Figure 6.4 Capacity Utilization Rates, Total and by Sex**




cent in 1979 to 60 percent in 1982. Similarly, aggregate CUR dipped slightly in the early 1990s—from 67 percent in 1989 to 65 percent in 1992—reflecting the recession in that period. The economy-wide CUR increased substantially during the period of prosperity following that recession. By 2000, aggregate CUR had risen to 72 percent, by far its highest value in the 26-year period. Indeed, over the entire period from 1995 to 2000, the CUR was at least 70 percent, a level that had not been attained during the prior two decades.

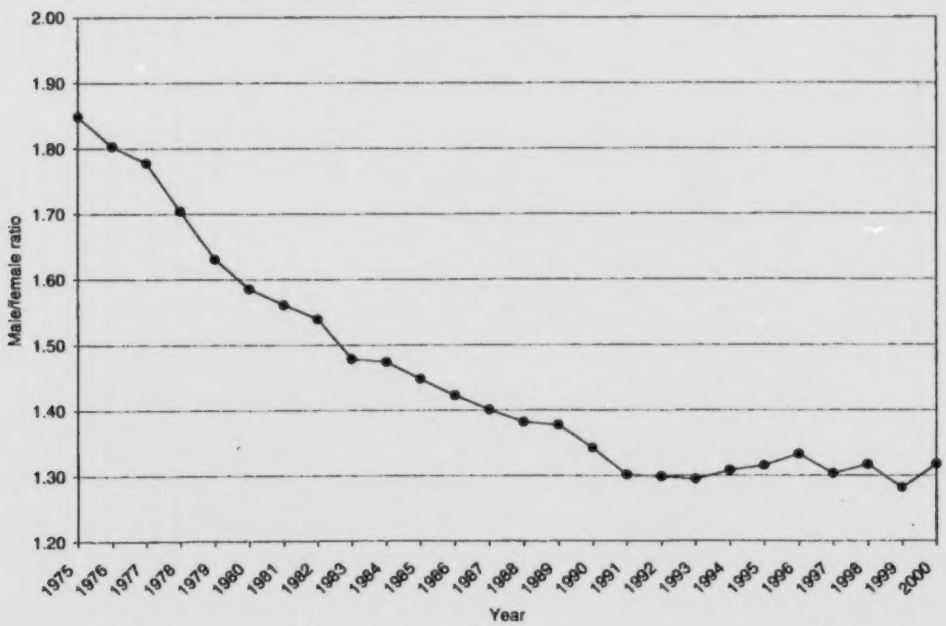
The CUR of working-age males is substantially higher than the overall CUR and that for women. It began the period at 75 percent and remained nearly constant until the end of the 1970s. During the recession of the early 1980s, male CUR fell to 70 percent. Following 1982, the CUR edged up steadily, again reaching 75 percent by 1989. A dip to 72 percent is recorded during the recession of the early 1990s, after which a surge in utilization occurred, raising the male CUR to 79 percent by 1996, and ultimately to 81 percent in 2000. This value

exceeded by six percentage points its highest level recorded during the period from 1975 to 1990.[9]

The CUR pattern for working-age women is quite different from that of men. At the beginning of the period, the CUR of women stood at 41 percent. From that low level of potential human capital utilized in market work, female capacity utilization began a rise that persists until the present. The recessions in the early 1980s and early 1990s are barely reflected in the series for women. Over the entire 26-year period, the female CUR rose by a remarkable 20 percentage points, or by 50 percent.

As Figure 6.5 shows, at the beginning of the period, the male-to-female CUR ratio stood at 1.85; by 1991, ratio had fallen to 1.30, a decrease of 29 percent. However, after 1991 the downward trend in the male–female CUR ratio ceased, ending the period at the 1.3 level.

**Figure 6.5 Ratio of Male to Female CUR**



## THE ANATOMY OF UNUTILIZED HUMAN CAPITAL: 1975–2000

Implicit in the estimates of EC and the rates of utilization of EC already presented is the question of the reasons why human capital is not utilized. In this section, we first measure the aggregate level of unutilized human capital services—the amount of unrealized potential earnings—and track this value over time. We show this pattern for both males and females. Then, we measure the per capita level of unrealized potential earnings, and trace the trends in this indicator over the 26-year period. Again, we distinguish these levels and trends by gender. These aggregate and per capita values of unrealized potential earnings can be allocated into a set of reasons for not using human capital in market work, some of which are voluntary and others involuntary. We present this allocation of unrealized potential earnings over time for all working-age individuals and for men and women separately.

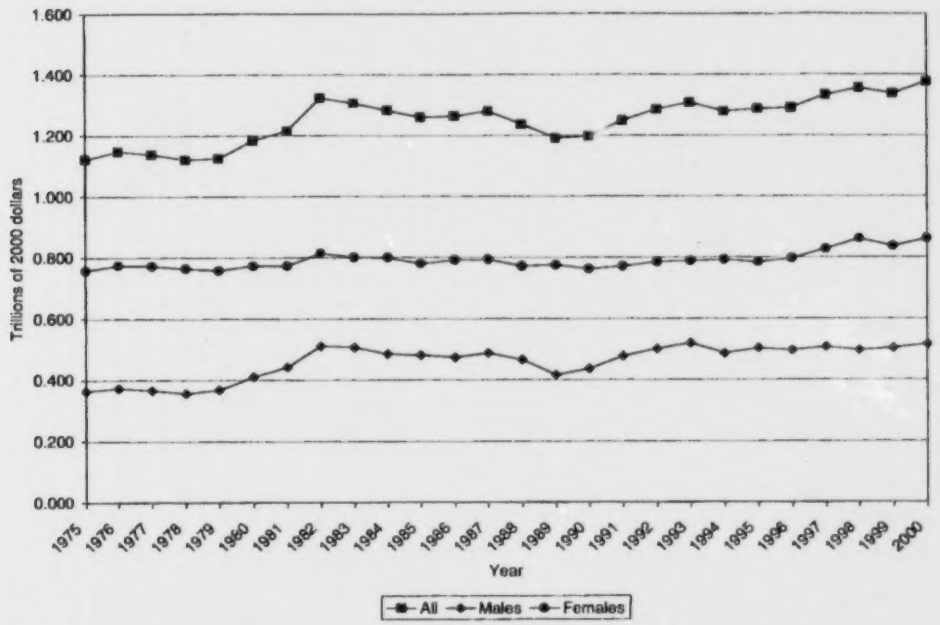
### Trends in Aggregate Unrealized Potential Earnings

To what extent has the U.S. economy failed to utilize the available stock of human capital in market-related productive activities? In this section, we measure the absolute level of potential human capital services that are not utilized in market activities over the 1975–2000 period. We show trends for the population as a whole and for gender subgroups.

Table 6.4 shows the aggregate level of the nation's human capital, measured as EC (from Table 6.1), with the allocation of aggregate EC to market work and to nonwork activities. We refer to the EC that is not allocated to work as unrealized potential earnings. These values are interpreted as the additional earned income and output that the stock of U.S. human capital could have generated if it had been used at its capacity, namely in FTFY work. In the aggregate, unrealized potential earnings in the U.S. economy have ranged from $1.1 trillion to $1.4 trillion per year over the 1975–2000 period, or from about one-quarter to one-third of aggregate EC.

The level and trend of aggregate unrealized potential earnings is also shown in Figure 6.6, broken down by gender. The aggregate level of unrealized potential earnings for males rose from $0.36 trillion in

**Figure 6.6 Aggregate Unrealized Potential Earnings, Total and by Sex**




1975 to $0.52 trillion in 2000, an increase of 44 percent. For women, however, aggregate unrealized potential earnings remained virtually constant; rising from $0.76 trillion in 1975, more than double the level for males, to $0.86 trillion in 2000, an increase of only 13 percent. As Figure 6.6 shows, this differential performance has resulted in a substantial narrowing of the gap between the male and female contributions to aggregate unrealized potential earnings over the 26-year period.

At the beginning of the period, about 32 percent of aggregate unrealized potential earnings was attributable to the unutilized human capital of men, while more than two-thirds of total unutilized human capital in the economy was attributable to nonwork activities of women. By the end of the period, the situation had changed substantially. In 2000, over 37 percent of unrealized potential earnings was attributable to men, while the women's share had fallen to 63 percent of the total.

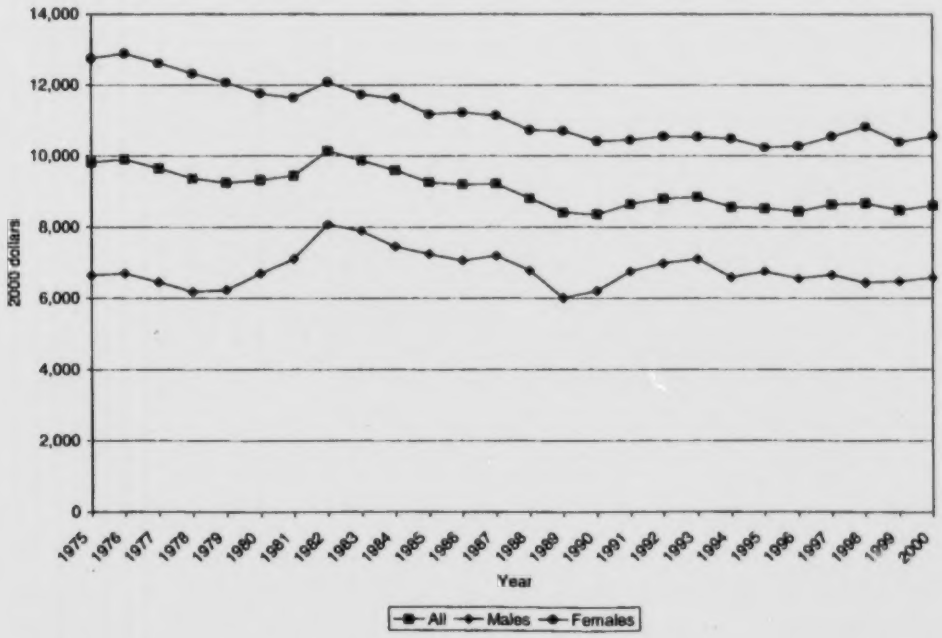
## Trends in Per Person Unrealized Potential Earnings

As we have seen in earlier comparisons, the aggregate figures reflect both the size of the population and the level and utilization of human capital per person. A more revealing picture of the level and patterns of unutilized capital is seen in the average, or per capita, figures for all working-age people and for men and women separately. These are shown in Figure 6.7.

Over the 1975–2000 period, unrealized potential earnings per person ranged from a low of about $8,400 (1989–1990, 1996, 1999) to over $10,100 in the recession year of 1982. Over the entire 26-year period, unrealized potential earnings drifted down from about $9,800 per working-age adult to about $8,600 per person, a decrease of about 12 percent.

The patterns between men and women are strikingly different. Per person unrealized potential earnings for men began the period at about $6,600 and ended the period at about the same level; while substantial cyclicality is observed in the male per capita pattern over time, virtu-

**Figure 6.7 Per Capita Unrealized Potential Earnings, Total and by Sex**



ally no trend is seen. For working-age women, however, the pattern is quite different. The extent of a cyclical pattern is quite dampened relative to that for men, and a persistent downward trend in unrealized potential earnings is in evidence. The per woman value of unutilized human capital was nearly $13,000 in 1975 but dropped to less than $11,000 by 2000, a reduction of over 15 percent.

## The Sources of Unrealized Potential Earnings

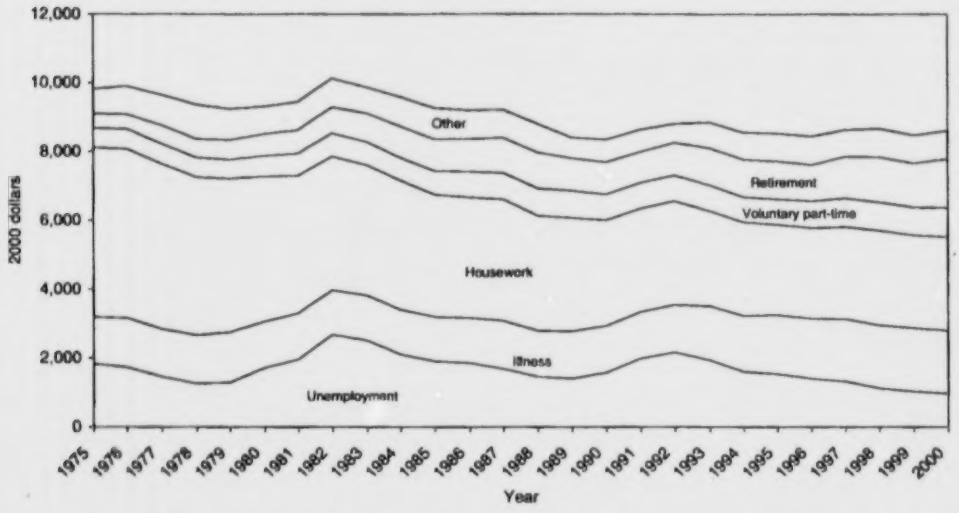
Human capital that is not used in market work is clearly allocated to other uses. Given our EC indicator of human capital, it is possible to measure the value of potential human capital services that are devoted to activities other than market work. From respondents' answers to questions regarding why they work less than the FTFY norm, unrealized potential earnings for each year can be decomposed into the following comprehensive set of categories representing alternative reasons why people do not fully use their EC: housework (including child care), work is not available (unemployed), illness/disability, retirement and voluntary part-time work, and other. (Appendix C describes the decomposition procedures we used.)

In this section, we describe these patterns, first for the entire working-age population, and then for males and females.

### Sources of unrealized potential earnings: entire working-age population

Tables 6.5 and 6.6 present the trends in aggregate unrealized potential earnings attributable to each of the sources and the percentage breakdown of this attribution. Table 6.7 shows the trend in per capita unrealized potential earnings. The level and trend of these components of unrealized potential earnings in per capita terms are shown for the entire working-age population in Figure 6.8. The top line in the figure is the absolute value of per capita unrealized potential earnings for the 1975–2000 period for the entire working-age population, also seen in the middle trend line in Figure 6.7. The components of this per capita value are the labeled areas beneath this total. The vertical sum of the component values for each year equals the per capita value of human capital services that are allocated to activities other than market work.

**Figure 6.8 Components of Per Capita Unrealized Potential Earnings, All Individuals**

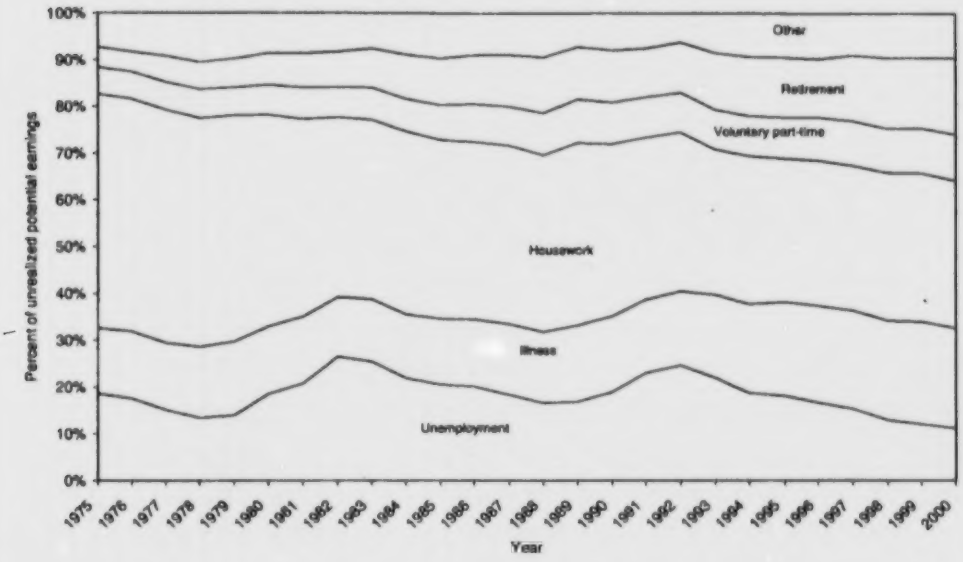



In Figure 6.9, we show the percentage of per capita unrealized potential earnings attributable to each of the sources over the period. The vertical sum of the labeled areas for each year equals 100 percent.

**Housework.** Clearly, the bulk of unutilized EC for the working-age population stems from the hours spent in housework. In 1975, over 50 percent of unrealized EC was accounted for by the decision (primarily of women) to engage in household activities rather than market work. The housework share of unrealized EC fell substantially over the period, and by 2000, time spent in housework accounted for only 32 percent of unutilized EC. In aggregate terms, the value of the time spent in housework activities in the economy totaled $562 billion in 1975 and fell relatively steadily to $435 billion by 2000. In only 6 of the 25 year-to-year changes did the aggregate value of time spent in housework increase. In per capita terms, the amount of unrealized potential earnings accounted for by housework began the period at about $4,900 per person, but this had fallen to about $2,700 per person by 2000.

**Unemployment.** The next largest source of unrealized potential earnings comes from a quite different source, namely a lack of employment opportunities—seeking work but being unable to find it. This

**Figure 6.9 Percentage Distribution of Per Capita Unrealized Potential Earnings, All Individuals**




source of unutilized human capital shows more cyclical sensitivity than any of the other sources of unutilized human capital, consistent with its close tie to the macroeconomic performance of the economy.

The aggregate value of human capital services lost to the U.S. economy because of a lack of employment opportunities ranged from a low of around $150 billion per year (1978 and 2000, or about 3 percent of GDP in 1978 and 1.5 percent in 2000) to $350 billion per year during the recession of the early 1980s and $320 billion per year during the recession of the early 1990s (about 6.3 and 4.3 percent of GDP, respectively). At the depth of those recessions, about 70 percent as much potential earnings was unrealized because of unemployment as because of housework.

In per capita terms, the value of unrealized potential earnings due to a lack of jobs ranged from a high of $2,700 per working-age person in 1982 to a low of about $1,000 per person in 2000. During the recessions of the early 1980s and early 1990s, over one-fourth of the gap between EC and actual earnings was accounted for by unemployment.

By contrast, in the years after 1998, only about 12 percent of unrealized potential earnings was accounted for by unemployment.

**Illness and disabling conditions.** As seen in Figures 6.8 and 6.9, illness or disabling health conditions form the third most important reason for human capital underutilization, accounting for a per capita value of about $1,300 to $1,400 per year until the early 1990s. However, beginning in 1992, the per capita loss of potential earnings attributable to illness or disability began a steady increase, reaching about $1,850 by 2000. This increase is unexpected and unexplained. However, even during the 1980s, some early warnings regarding a growing incidence of illness/disability problems among the working-age population were reported in the literature.[10]

In aggregate terms, illness or disability accounted for about $150–200 billion per year of unrealized potential earnings from 1975 to the early 1990s, or about 14–16 percent of the total. This total began increasing steadily in 1992. By 2000, about $300 billion of potential earnings were lost annually due to this factor, accounting for 21 percent of total unrealized potential earnings.

**Retirement and voluntary part-time work.** Two other patterns in these figures should be noted. First, for the entire working-age population, unrealized potential earnings attributable to retirement began the period at a low level of about $50 billion per year, or 4 percent of total unutilized human capital. By the end of the period, retirement accounted for $230 billion, or over 16 percent of the total. In per capita terms, the amount of human capital unutilized because of retirement rose from $425 per person to over $1,400 per person. This source of underutilization is the most rapidly growing reason why working-age people fail to fully use their human capital in market activities.

The other rapidly growing reason for not using human capital is the voluntary choice of part-time, rather than full-time work. At the beginning of the period, this category accounted for about 6 percent of unutilized EC. The movement toward part-time work increased steadily over the 26-year period. By 2000, nearly 10 percent of unrealized potential earnings was accounted for by this category.

**Sources of unrealized potential earnings: males and females**

Figures 6.10 and 6.11 present the sources of nonutilization for males, analogous to Figures 6.8 and 6.9. Figures 6.12 and 6.13 present these patterns for women. Table 6.8 summarizes the gender differences in these patterns over the 1975–2000 period in absolute change, per capita change, and change in percentage points of the gender-specific total. Here, we will note only the primary differences between the male and female patterns.

Clearly the largest difference between males and females is in the housework category. This reason is a very small source of unrealized potential earnings for working-age males, accounting for $4 billion per year in 1975 (1 percent of the total), rising to $28 billion in 2000 (over 5 percent of the total). Although the growth in the per capita value of this component for males is substantial (from $80 to $350), this reason for males not meeting the FTFY work norm is small in absolute terms.

For women, however, housework dominated the sources of unrealized potential earnings, accounting for over $550 billion in 1975. By 2000, total unrealized potential earnings for women had decreased substantially, driven by the reduction in time spent in housework. By 2000, the per capita unutilized EC due to housework had fallen from $9,400 to $5,000, from 74 percent of total unrealized EC of women to 47 percent.

There are also substantial gender differences in the extent of unrealized potential earnings due to involuntary unemployment. As seen in Figures 6.10 and 6.11, per capita unemployment losses for men range from $1,200 to $3,600 over the 26-year period, showing substantial sensitivity to the business cycle. Female per capita unemployment losses are about one-half those of men, ranging from $750 (2000) to $1,800 (1982) per year, and they show much less responsiveness to macroeconomic conditions.

The final three categories (besides the "other" residual)—illness/disability, retirement, and voluntary part-time work—also show quite different gender patterns. While unrealized potential earnings due to these reasons all increased for both men and women over the period, larger increases tend to be recorded for women. For these three sources of unutilized EC, the per capita increases for women totaled nearly $1,800; the increases in unrealized potential earnings attributable to

**Figure 6.10 Components of Per Capita Unrealized Potential Earnings, All Males**

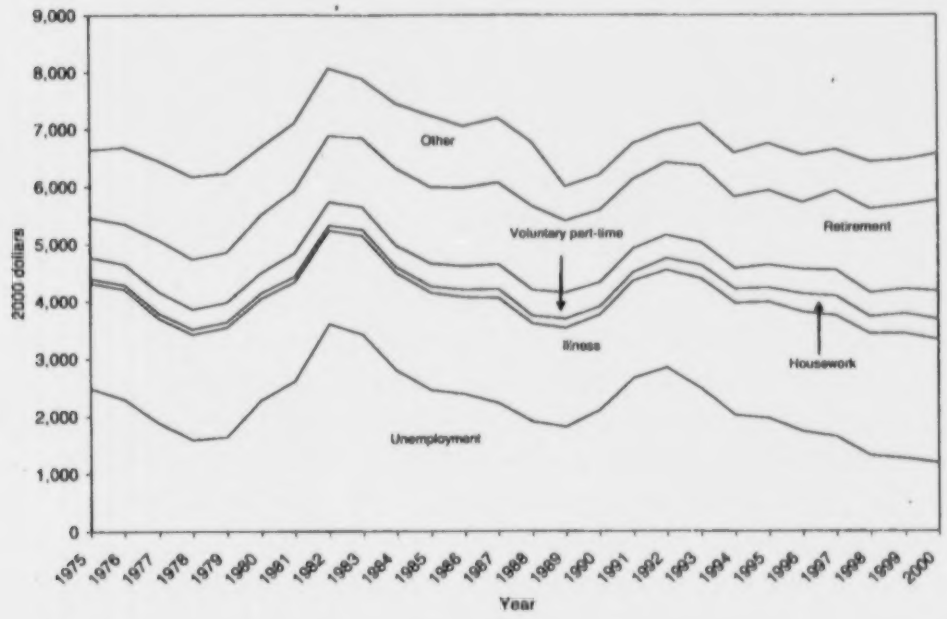



**Figure 6.11 Percentage Distribution of Per Capita Unrealized Potential Earnings, All Males**

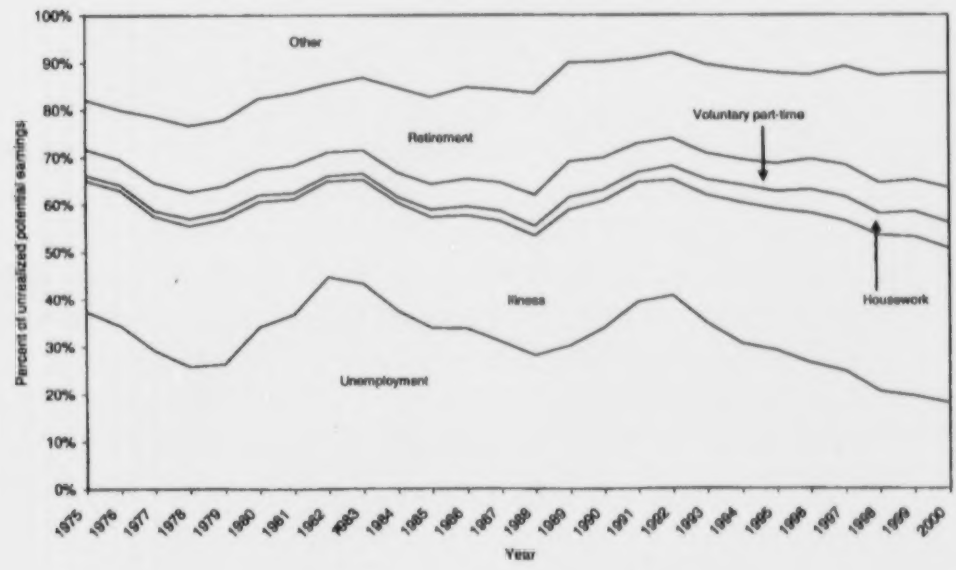


**Figure 6.12 Components of Per Capita Unrealized Potential Earnings, All Females**

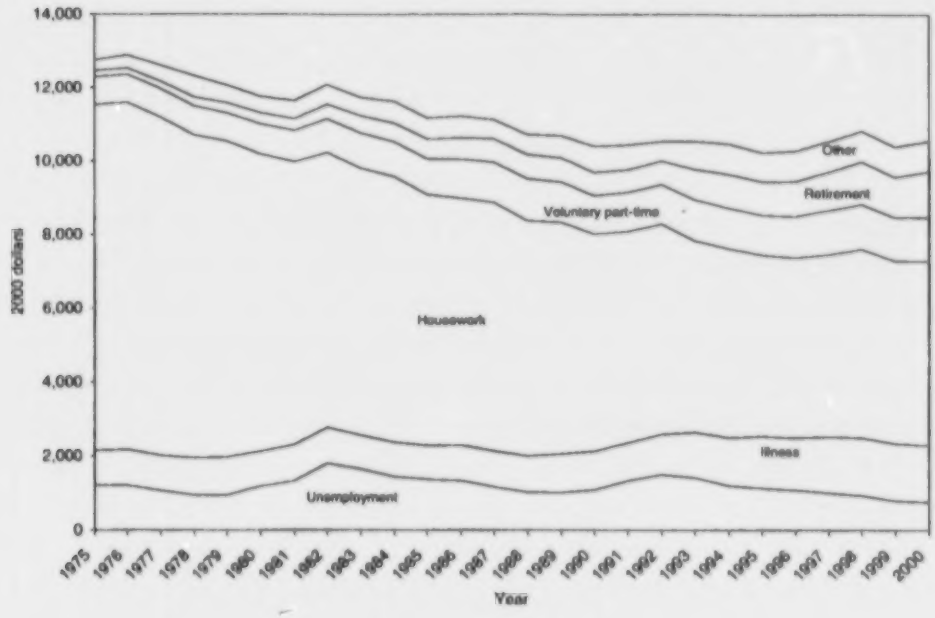
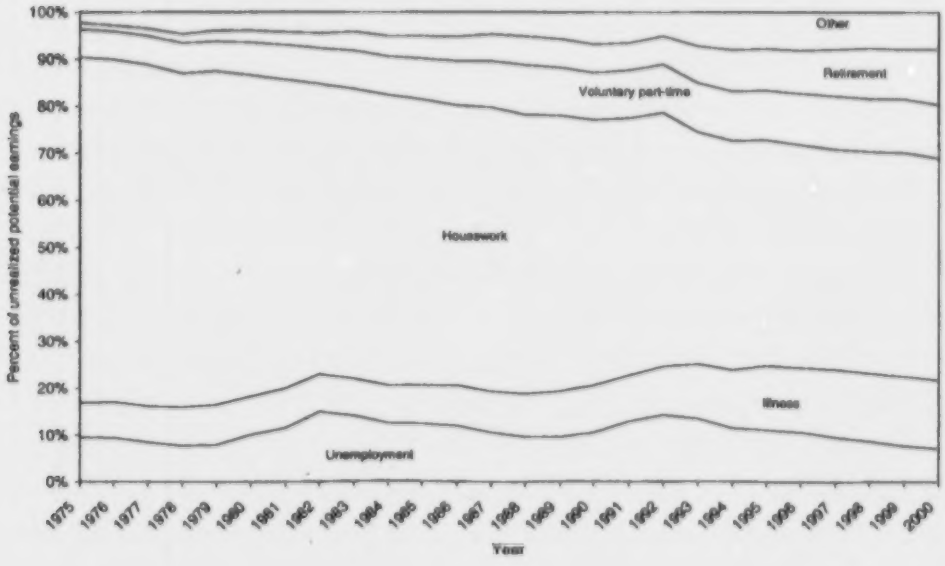



**Figure 6.13 Percentage Distribution of Per Capita Unrealized Potential Earnings, All Females**



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these reasons for men totaled only about $1,000. As a percentage of total unrealized potential earnings, these three sources rose by 23 percentage points for women and by 21 percentage points for men.

### Exogenous constraints versus individual responses to incentives

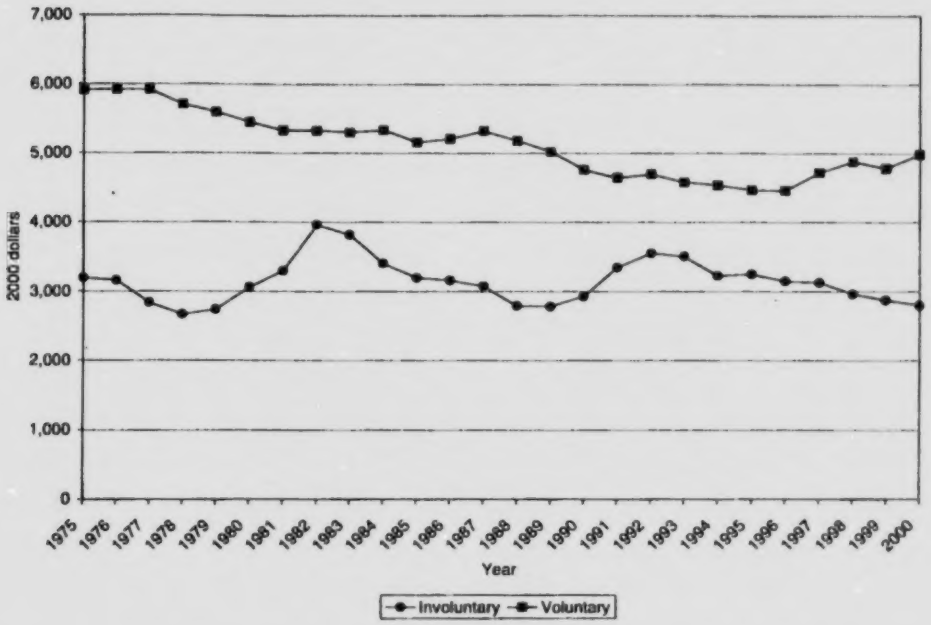
The reasons that working-age people fail to fully utilize their human capital in market work activities can be roughly allocated into two categories—reasons that imply constraints imposed on individuals (exogenous or involuntary constraints) and reasons that indicate their own responses to the incentives and opportunities that are open to them (individual or voluntary responses). The underutilization of human capital due to exogenous constraints carries quite different social and policy implications than that due to individual responses to incentives.

To explore these two sources for unutilized human capital, we divide unrealized potential earnings (EC less EC attributable to work) into two components. The first component includes reasons arising from individual responses to incentives (retirement, voluntary part-time work, and housework). The second includes those reasons stemming from exogenous constraints on the underutilization of human capital (work not available and illness).[11]

This attribution of the gap between unrealized potential earnings into exogenous constraint and individual response categories takes at face value what respondents state to be the most important reason for their not working. There may, in fact, be other contributing reasons, or a more important reason that respondents have disguised. For example, an individual may voluntarily choose not to work, but may report illness (included in our "exogenous constraint" category) in order to indicate a more acceptable reason for not working.

Figure 6.14 shows the level of per capita unrealized potential earnings due to exogenous constraint and individual response reasons for the entire working-age population (see also Tables 6.5–6.7). An overall downward trend in the voluntary choice reason for not utilizing human capital is observed in the series—per person, voluntary nonuse of human capital decreased from about $5,900 in the late 1970s to about $4,800 in the late 1990s. Most of this decrease is driven by the reduction in the housework reason of nonutilization of human capital for women. Over the entire period, the aggregate individual response rea-

**Figure 6.14 Per Capita Unrealized Potential Earnings: Voluntary and Involuntary, All Individuals**




son for the failure to utilize human capital has stayed in the narrow range of $680 to $800 billion.

The level of per capita involuntary reasons for nonwork is highly sensitive to the level of economic performance. For example, from 1978 to the trough of the recession in 1982, per capita involuntary nonuse of human capital increased from about $2,700 per person to $4,000 per person, an increase of nearly 50 percent. There seems to be relatively little long-run trend in the involuntary nonuse of human capital in the U.S. economy. Although the minimum per person value of $2,700 reached in 1978 was not attained after the prolonged period of growth following the recession of the early 1980s, this value was again attained at the end of the sustained prosperity of the 1990s. The failure of this exogenous constraint reason to fall over the period is attributable to the persistent growth in the illness reason for nonwork, especially in the most recent period. At its peak levels, involuntary losses of unrealized potential earnings cost the U.S. economy nearly $0.5 trillion per year.

Figures 6.15 and 6.16 present the involuntary/voluntary reasons for unrealized potential earnings by gender. For working-age men, there is a strong upward trend in the voluntary sources of unrealized potential earnings, from about $1,200 per person in 1975 to double that in 2000. This increase is largely accounted for by the retirement reason for work at less than the FTFY level. The involuntary reasons for unrealized potential earnings are very procyclical and, in per capita terms, range from $3,300 (2000) to $5,200 (1982) over the period. There appears to be a very small negative long-term trend in these involuntary reasons over the 26-year period. However, during the sustained period of growth in the 1990s, per capita involuntary unrealized potential earnings fell from $4,500 to $3,300.

The pattern for women is quite the opposite. Voluntary reasons dominate the sources of unrealized potential earnings, and the losses here decreased steadily over the period, in line with the increased labor force participation rate of women. However, even at the end of the period, voluntary unrealized potential earnings attributed to the average working-age woman—$7,400—are more than triple those attributed to the average man. The involuntary source of unrealized potential earnings tends to be very insensitive to the level of macroeconomic performance, at least as compared with men. Interestingly, there does seem to be a slight upward trend in this source of unutilized human capital, such that even during the economic prosperity after the recession of the early 1990s the level of involuntary unrealized potential earnings is only slightly below its recession highs.

## SUMMARY AND CONCLUSIONS

The level of human capital in the U.S. economy is enormous. By our estimates, the annual rental value of the human capital stock (EC) was about $6.3 trillion in 2000 and had grown by nearly 74 percent since the mid 1970s. The average working-age person in the nation had over $39,000 of EC in 2000, with average male EC equal to over $46,500 and average female EC equal to about $32,000. The gap between male and female EC narrowed substantially over the 1975–2000 period, however.

**Figure 6.15 Per Capita Unrealized Potential Earnings: Voluntary and Involuntary, All Males**

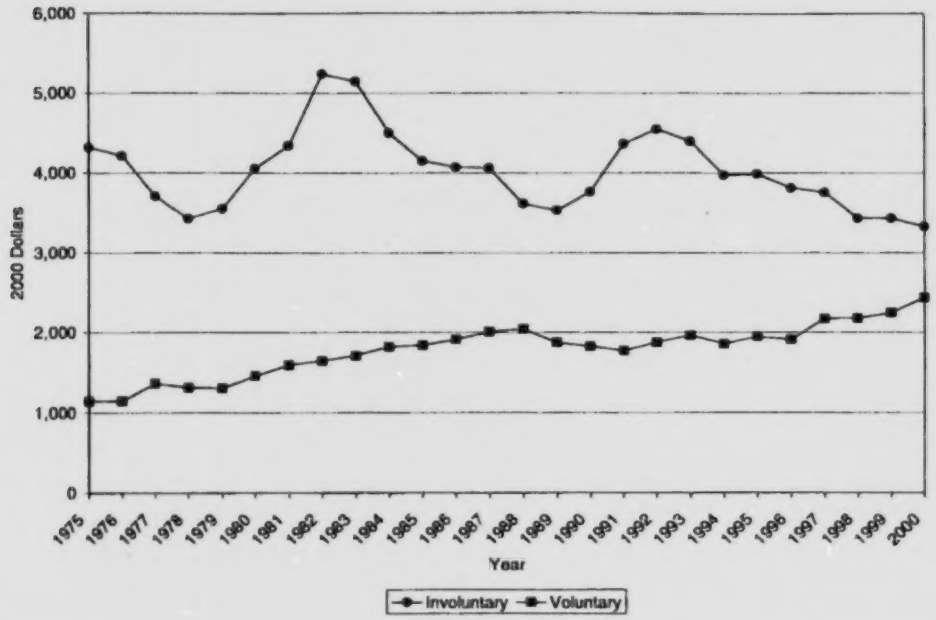
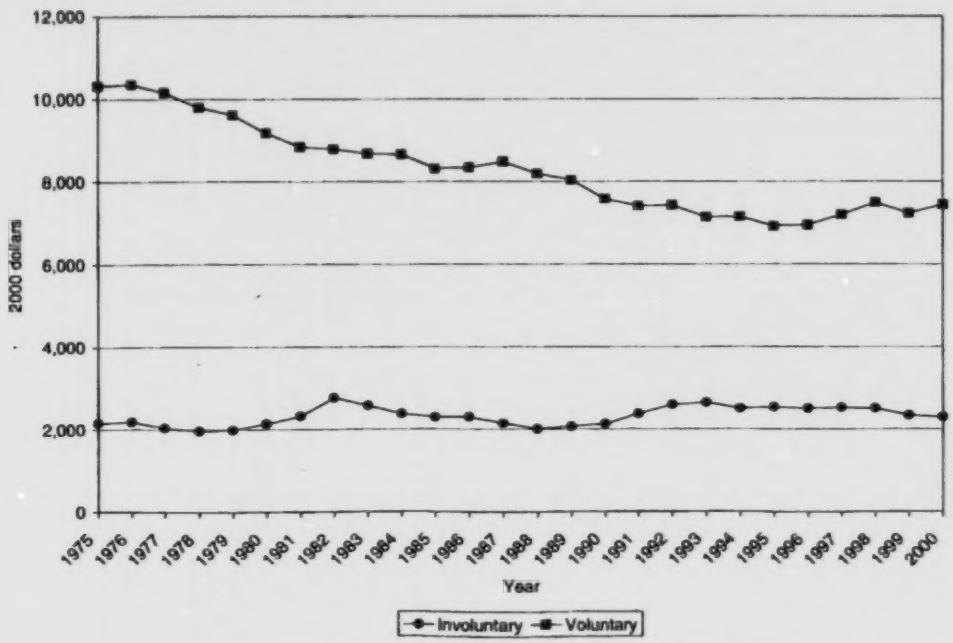



**Figure 6.16 Per Capita Unrealized Potential Earnings: Voluntary and Involuntary, All Females**



Human capital contributes to the economy primarily through its use in market production. We estimate that about 72 percent of U.S. human capital was utilized in the most recent period (2000). This percentage fluctuated substantially over the 1975–2000 period, from a low of 60 percent in 1982 to the 72 percent figure in the most recent period. Male utilization was over 80 percent in the most recent period, while that of females was over 60 percent. The gender gap in the utilization of human capital has narrowed substantially over the 1975–2000 period, from a male–female ratio of 1.85 in 1975 to 1.32 by 2000. In 2000, unrealized potential earnings averaged about $6,600 for men, or about 14 percent of their EC; for women, unrealized potential earnings averaged nearly $11,000, or about 34 percent of their EC. These patterns are among the most striking results of our analysis.

In total, unutilized human capital in the United States has ranged from about one-third of total human capital at the beginning of the period to about 22 percent at the end. This reduction in unrealized potential earnings is largely attributable to the increased utilization of human capital by women.

For the economy as a whole, housework is the primary source of unutilized human capital, accounting for over 50 percent of unrealized potential earnings in 1975 but only about 32 percent by 2000. Again, the radical increase in female utilization accounts for this pattern. Unemployment is the second largest source of unrealized potential earnings. During serious recessions, about $350 billion of potential earnings is lost to the U.S. economy due to this reason. Most of this peak level of loss—over two-thirds—is accounted for by men who seek work but are unable to find it. Even in robust periods, about $150 billion of unrealized potential earnings is attributed to the inability of working-age people to find a job.

We allocated the several sources of unutilized human capital into exogenous constraint (involuntary) and individual response (voluntary) reasons. The latter basis of unutilized human capital accounts for the bulk of the total—nearly 60 percent of this total unrealized potential earnings is accounted for by voluntary nonwork. On a per capita basis, voluntary nonutilization of human capital has been falling steadily in the U.S. economy due largely to a reduction in home activities, associated with the rapid increase in women's market work. This has been somewhat offset by increases in voluntary retirement decisions by both

men and women. Working-age retirement accounts for a substantial and growing source of unrealized potential earnings, totaling nearly $230 billion per year in 2000.

Illness/disability seems to be a secularly increasing source of lost potential earnings. By the end of the period, the U.S. economy appeared to be sacrificing nearly $300 billion in earnings and income due to this reason. Recent years have seen particularly large increases in this source of loss.

## Notes

1. As we discussed in Chapter 5, the EC measure fails to consider a number of aspects of the skills and talents that people possess that are not valued by the market. Home production (e.g., parenting skills), external effects (such as community participation), socially valued outputs in the form of volunteer activities, and the direct "consumption value" associated with the possession of skills and knowledge are all examples. Moreover, our measure is an indicator of "gross" human capital; it does not net out the value of resources required for human capital to be productive. Finally, it is an annual and not a present value concept.
2. GDP growth also reflects changes in the employment of people younger than age 18 and older than age 65, groups that are excluded from our measure of EC.
3. By comparison, real GDP per dollar of actual earnings increased from $1.96 to $2.20 over this period.
4. From 1975 to 2000, the size of the nation's working-age population grew from 114.3 million to 160 million, or by 40 percent. Table B.4 in Appendix B presents changes in the size of the working-age population, in total and by gender, race, age, and education groups over the 1975–2000 period.
5. The term "market capacity utilization" may more fully capture the concept that we employ. However, to retain consistency with the literature on the employment of physical capital, we use the term "capacity utilization" in the remainder of the volume.
6. We employ actual (survey reported) earnings in studying the utilization of human capital in this analysis, even though it is somewhat inconsistent with subsequent estimates of the reasons for failing to fully utilize human capital discussed below. In that analysis, earnings are defined as the actual hours that a person worked times the wage rate that she would earn if working FTFY, rather than her actual wage rate. The overall patterns of utilization are very similar between the two estimates. Estimates of human capital utilization based on this concept are available from the authors.
7. We note that changes in a variety of labor-market institutions or labor-market distortions over time will be reflected in the trend of aggregate measures of both earnings and EC. For example, the presumed reduction in the influence of labor unions on wages (associated with the fall in union membership over the past two

decades) could lead to a downward trend in both earnings and EC due to a decrease in wage rates. Changes in the efficiency premium paid to avoid shirking or to compensate for increased probabilities of seasonal employment or temporary layoffs are also reflected in both wage rates and EC. Finally, changes in the extent of racial or gender discrimination associated with the extent of work activity will also be reflected in our CUR estimates.

8. For example, if the wage rate reflects a payment by employers to avoid shirking, or the premium paid to compensate workers for seasonal components or unemployment risks in particular jobs, our calculations of EC assume these factors would be unchanged if all working-age people would work FTFY.
9. Taking a somewhat different approach but also using information from the CPS, Hout and Hanley (2002) showed an increase in aggregate work hours of married couple families from 1968 to 2001. They also indicated that this increase has contributed to the increase in inequality of household earned incomes. Our analysis and that of Hout and Hanley directly address the controversy over the extent of increased work time associated with the assertion by Schor (1991) regarding "overworked" Americans.
10. See Wolfe and Haveman (1990) and Chirikos (1986). Several factors may account for this possible trend, including increased job-related stress, an increased willingness to describe mental illness and emotional problems as disabling conditions, an overall heightened awareness of medical problems and their acceptance as a reason for not working, and the rapid increase in take-up rates in public disability transfer programs, especially after the late 1980s. (From 1990 to 2000, the number of beneficiaries of Social Security Disability Insurance benefits increased from about 3 million to about 5 million [U.S. Social Security Administration 2001].)
11. For this analysis, we neglect the "other" category, which seems incapable of being allocated to one or the other of the categories. Table 6.6, which presents the percentage allocations of unrealized potential earnings, shows involuntary and voluntary as a percent of the total, not as a percent of total net of "other." Thus, involuntary and voluntary will not total 100 percent.

**Table 6.1 Aggregate EC, Total and by Sex, 1975–2000 (Trillions of 2000 Dollars)**

| Year | Total | Sex | |
|---|---|---|---|
| | | Men | Women |
| 1975 | 3.604 | 2.200 | 1.404 |
| 1976 | 3.783 | 2.317 | 1.466 |
| 1977 | 3.880 | 2.371 | 1.509 |
| 1978 | 4.028 | 2.468 | 1.561 |
| 1979 | 4.105 | 2.516 | 1.589 |
| 1980 | 4.171 | 2.532 | 1.639 |
| 1981 | 4.222 | 2.578 | 1.644 |
| 1982 | 4.315 | 2.591 | 1.724 |
| 1983 | 4.384 | 2.625 | 1.759 |
| 1984 | 4.556 | 2.732 | 1.824 |
| 1985 | 4.633 | 2.785 | 1.847 |
| 1986 | 4.817 | 2.882 | 1.935 |
| 1987 | 4.882 | 2.899 | 1.983 |
| 1988 | 4.936 | 2.922 | 2.014 |
| 1989 | 4.967 | 2.924 | 2.043 |
| 1990 | 4.897 | 2.858 | 2.038 |
| 1991 | 4.926 | 2.864 | 2.062 |
| 1992 | 5.023 | 2.904 | 2.119 |
| 1993 | 5.071 | 2.930 | 2.141 |
| 1994 | 5.175 | 2.985 | 2.190 |
| 1995 | 5.364 | 3.158 | 2.206 |
| 1996 | 5.480 | 3.193 | 2.287 |
| 1997 | 5.727 | 3.350 | 2.377 |
| 1998 | 5.949 | 3.442 | 2.507 |
| 1999 | 6.034 | 3.502 | 2.532 |
| 2000 | 6.261 | 3.646 | 2.615 |

**Table 6.2 Earnings Capacity per Person, Total and by Sex, 1975–2000 (2000 dollars)**

| Year | Total | Sex | |
|---|---|---|---|
| | | Men | Women |
| 1975 | 31,541 | 40,136 | 23,613 |
| 1976 | 32,638 | 41,516 | 24,395 |
| 1977 | 32,894 | 41,757 | 24,668 |
| 1978 | 33,630 | 42,743 | 25,151 |
| 1979 | 33,709 | 42,661 | 25,301 |
| 1980 | 32,825 | 41,283 | 24,936 |
| 1981 | 32,819 | 41,445 | 24,742 |
| 1982 | 33,041 | 40,958 | 25,601 |
| 1983 | 33,133 | 40,934 | 25,798 |
| 1984 | 34,075 | 42,059 | 26,531 |
| 1985 | 34,034 | 41,988 | 26,473 |
| 1986 | 35,041 | 43,034 | 27,448 |
| 1987 | 35,143 | 42,823 | 27,842 |
| 1988 | 35,128 | 42,559 | 28,030 |
| 1989 | 35,040 | 42,169 | 28,214 |
| 1990 | 34,136 | 40,669 | 27,861 |
| 1991 | 34,092 | 40,515 | 27,940 |
| 1992 | 34,372 | 40,459 | 28,495 |
| 1993 | 34,287 | 40,083 | 28,624 |
| 1994 | 34,639 | 40,443 | 28,970 |
| 1995 | 35,504 | 42,415 | 28,788 |
| 1996 | 35,824 | 42,251 | 29,549 |
| 1997 | 37,067 | 44,004 | 30,329 |
| 1998 | 38,001 | 44,679 | 31,531 |
| 1999 | 38,189 | 45,126 | 31,491 |
| 2000 | 39,138 | 46,505 | 32,058 |

**Table 6.3 Capacity Utilization Rate, Total and by Sex, 1975–2000**

| | | Sex | |
|---|---|---|---|
| Year | Total | Men | Women |
| 1975 | 0.62 | 0.75 | 0.41 |
| 1976 | 0.61 | 0.74 | 0.41 |
| 1977 | 0.62 | 0.75 | 0.42 |
| 1978 | 0.63 | 0.75 | 0.44 |
| 1979 | 0.63 | 0.74 | 0.46 |
| 1980 | 0.62 | 0.73 | 0.46 |
| 1981 | 0.62 | 0.72 | 0.46 |
| 1982 | 0.60 | 0.70 | 0.46 |
| 1983 | 0.61 | 0.70 | 0.47 |
| 1984 | 0.62 | 0.71 | 0.48 |
| 1985 | 0.64 | 0.73 | 0.50 |
| 1986 | 0.64 | 0.73 | 0.51 |
| 1987 | 0.65 | 0.73 | 0.52 |
| 1988 | 0.66 | 0.75 | 0.54 |
| 1989 | 0.67 | 0.75 | 0.55 |
| 1990 | 0.66 | 0.74 | 0.55 |
| 1991 | 0.65 | 0.72 | 0.56 |
| 1992 | 0.65 | 0.72 | 0.55 |
| 1993 | 0.65 | 0.72 | 0.56 |
| 1994 | 0.66 | 0.74 | 0.56 |
| 1995 | 0.70 | 0.78 | 0.59 |
| 1996 | 0.71 | 0.79 | 0.59 |
| 1997 | 0.70 | 0.77 | 0.59 |
| 1998 | 0.70 | 0.78 | 0.59 |
| 1999 | 0.71 | 0.78 | 0.61 |
| 2000 | 0.72 | 0.81 | 0.61 |

**Table 6.4 Aggregate EC, Capacity Allocated to Work, and Unrealized Potential Earnings, 1975–2000 (Trillions of 2000 Dollars)**

| Year | Aggregate EC | EC allocated to work | Unrealized potential earnings | Unrealized potential earnings as a percent of EC |
|---|---|---|---|---|
| 1975 | 3.604 | 2.482 | 1.122 | 31.1 |
| 1976 | 3.783 | 2.635 | 1.148 | 30.3 |
| 1977 | 3.880 | 2.742 | 1.138 | 29.3 |
| 1978 | 4.028 | 2.907 | 1.121 | 27.8 |
| 1979 | 4.105 | 2.980 | 1.125 | 27.4 |
| 1980 | 4.171 | 2.988 | 1.183 | 28.4 |
| 1981 | 4.222 | 3.007 | 1.215 | 28.8 |
| 1982 | 4.315 | 2.991 | 1.324 | 30.7 |
| 1983 | 4.384 | 3.078 | 1.306 | 29.8 |
| 1984 | 4.556 | 3.273 | 1.283 | 28.2 |
| 1985 | 4.633 | 3.373 | 1.260 | 27.2 |
| 1986 | 4.817 | 3.554 | 1.264 | 26.2 |
| 1987 | 4.882 | 3.602 | 1.280 | 26.2 |
| 1988 | 4.936 | 3.700 | 1.236 | 25.0 |
| 1989 | 4.967 | 3.776 | 1.191 | 24.0 |
| 1990 | 4.897 | 3.699 | 1.197 | 24.5 |
| 1991 | 4.926 | 3.678 | 1.248 | 25.3 |
| 1992 | 5.023 | 3.738 | 1.285 | 25.6 |
| 1993 | 5.071 | 3.764 | 1.308 | 25.8 |
| 1994 | 5.175 | 3.897 | 1.278 | 24.7 |
| 1995 | 5.364 | 4.077 | 1.287 | 24.0 |
| 1996 | 5.480 | 4.189 | 1.291 | 23.6 |
| 1997 | 5.727 | 4.394 | 1.333 | 23.3 |
| 1998 | 5.949 | 4.593 | 1.356 | 22.8 |
| 1999 | 6.034 | 4.697 | 1.338 | 22.2 |
| 2000 | 6.261 | 4.885 | 1.377 | 22.0 |

**Table 6.5 Aggregate Unrealized Potential Earnings, All Individuals, Total and by Category, 1975–2000 (Trillions of 2000 Dollars)**

| Year | Categories of unrealized potential earnings | | | | | | Voluntary/involuntary unrealized potential earnings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Unemployment | Illness | Housework | Voluntary | Retirement | Other | Involuntary | Voluntary | Total |
| 1975 | 0.208 | 0.156 | 0.562 | 0.065 | 0.049 | 0.082 | 0.365 | 0.676 | 1.122 |
| 1976 | 0.201 | 0.165 | 0.570 | 0.066 | 0.050 | 0.096 | 0.366 | 0.686 | 1.148 |
| 1977 | 0.172 | 0.163 | 0.566 | 0.068 | 0.064 | 0.105 | 0.335 | 0.698 | 1.138 |
| 1978 | 0.151 | 0.168 | 0.549 | 0.069 | 0.065 | 0.119 | 0.319 | 0.683 | 1.121 |
| 1979 | 0.156 | 0.177 | 0.544 | 0.068 | 0.069 | 0.111 | 0.334 | 0.681 | 1.125 |
| 1980 | 0.218 | 0.171 | 0.535 | 0.076 | 0.081 | 0.102 | 0.389 | 0.692 | 1.183 |
| 1981 | 0.252 | 0.172 | 0.514 | 0.083 | 0.089 | 0.105 | 0.424 | 0.686 | 1.215 |
| 1982 | 0.349 | 0.168 | 0.508 | 0.087 | 0.100 | 0.111 | 0.518 | 0.696 | 1.324 |
| 1983 | 0.331 | 0.174 | 0.501 | 0.090 | 0.110 | 0.100 | 0.505 | 0.701 | 1.306 |
| 1984 | 0.281 | 0.175 | 0.501 | 0.090 | 0.122 | 0.114 | 0.455 | 0.713 | 1.283 |
| 1985 | 0.259 | 0.176 | 0.483 | 0.094 | 0.126 | 0.123 | 0.435 | 0.702 | 1.260 |
| 1986 | 0.254 | 0.180 | 0.481 | 0.102 | 0.133 | 0.113 | 0.434 | 0.716 | 1.264 |
| 1987 | 0.234 | 0.193 | 0.491 | 0.107 | 0.142 | 0.114 | 0.427 | 0.739 | 1.280 |
| 1988 | 0.205 | 0.187 | 0.469 | 0.112 | 0.148 | 0.116 | 0.392 | 0.728 | 1.236 |
| 1989 | 0.199 | 0.195 | 0.466 | 0.111 | 0.134 | 0.086 | 0.394 | 0.711 | 1.191 |
| 1990 | 0.226 | 0.193 | 0.442 | 0.106 | 0.134 | 0.095 | 0.420 | 0.682 | 1.197 |
| 1991 | 0.287 | 0.196 | 0.433 | 0.108 | 0.131 | 0.094 | 0.483 | 0.672 | 1.248 |
| 1992 | 0.316 | 0.203 | 0.439 | 0.110 | 0.138 | 0.080 | 0.519 | 0.687 | 1.285 |
| 1993 | 0.287 | 0.232 | 0.407 | 0.111 | 0.160 | 0.111 | 0.519 | 0.678 | 1.308 |
| 1994 | 0.239 | 0.243 | 0.405 | 0.110 | 0.162 | 0.119 | 0.481 | 0.677 | 1.278 |

(continued)

**Table 6.5 (continued)**

| Year | Categories of unrealized potential earnings | | | | | | Voluntary/involuntary unrealized potential earnings | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Unemployment | Illness | Housework | Voluntary | Retirement | Other | Involuntary | Voluntary | |
| 1995 | 0.233 | 0.258 | 0.395 | 0.113 | 0.167 | 0.122 | 0.491 | 0.675 | 1.287 |
| 1996 | 0.215 | 0.266 | 0.402 | 0.119 | 0.162 | 0.127 | 0.481 | 0.682 | 1.291 |
| 1997 | 0.203 | 0.280 | 0.414 | 0.129 | 0.187 | 0.121 | 0.483 | 0.729 | 1.333 |
| 1998 | 0.176 | 0.288 | 0.429 | 0.129 | 0.205 | 0.129 | 0.463 | 0.763 | 1.356 |
| 1999 | 0.162 | 0.292 | 0.425 | 0.129 | 0.202 | 0.128 | 0.454 | 0.755 | 1.338 |
| 2000 | 0.154 | 0.294 | 0.435 | 0.136 | 0.227 | 0.132 | 0.448 | 0.797 | 1.377 |

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**Table 6.6 Percentage Allocation of Unrealized Potential Earnings, All Individuals, Total and by Category, 1975–2000**

| Year | Categories of unrealized potential earnings | | | | | | Voluntary/involuntary unrealized potential earnings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Unemployment | Illness | Housework | Voluntary | Retirement | Other | Involuntary | Voluntary | Total |
| 1975 | 18.57 | 13.94 | 50.08 | 5.79 | 4.34 | 7.27 | 32.51 | 60.21 | 100.00 |
| 1976 | 17.52 | 14.37 | 49.67 | 5.78 | 4.33 | 8.33 | 31.90 | 59.78 | 100.00 |
| 1977 | 15.12 | 14.28 | 49.73 | 6.00 | 5.62 | 9.24 | 29.40 | 61.36 | 100.00 |
| 1978 | 13.44 | 15.02 | 48.96 | 6.19 | 5.80 | 10.58 | 28.46 | 60.96 | 100.00 |
| 1979 | 13.90 | 15.74 | 48.32 | 6.04 | 6.11 | 9.89 | 29.64 | 60.47 | 100.00 |
| 1980 | 18.42 | 14.43 | 45.23 | 6.43 | 6.85 | 8.65 | 32.85 | 58.50 | 100.00 |
| 1981 | 20.71 | 14.19 | 42.30 | 6.80 | 7.34 | 8.66 | 34.90 | 56.44 | 100.00 |
| 1982 | 26.39 | 12.71 | 38.41 | 6.59 | 7.54 | 8.36 | 39.10 | 52.55 | 100.00 |
| 1983 | 25.38 | 13.30 | 38.32 | 6.92 | 8.44 | 7.65 | 38.68 | 53.68 | 100.00 |
| 1984 | 21.87 | 13.62 | 39.06 | 7.02 | 9.52 | 8.90 | 35.49 | 55.61 | 100.00 |
| 1985 | 20.53 | 13.98 | 38.30 | 7.46 | 9.98 | 9.74 | 34.52 | 55.74 | 100.00 |
| 1986 | 20.08 | 14.27 | 38.08 | 8.10 | 10.49 | 8.98 | 34.35 | 56.67 | 100.00 |
| 1987 | 18.30 | 15.06 | 38.34 | 8.34 | 11.08 | 8.87 | 33.36 | 57.77 | 100.00 |
| 1988 | 16.55 | 15.14 | 37.90 | 9.05 | 11.95 | 9.40 | 31.69 | 58.91 | 100.00 |
| 1989 | 16.72 | 16.36 | 39.15 | 9.29 | 11.28 | 7.20 | 33.08 | 59.72 | 100.00 |
| 1990 | 18.91 | 16.16 | 36.89 | 8.88 | 11.23 | 7.93 | 35.07 | 57.00 | 100.00 |
| 1991 | 22.98 | 15.71 | 34.68 | 8.64 | 10.48 | 7.50 | 38.69 | 53.80 | 100.00 |
| 1992 | 24.59 | 15.79 | 34.13 | 8.54 | 10.75 | 6.21 | 40.38 | 53.42 | 100.00 |
| 1993 | 21.94 | 17.75 | 31.11 | 8.51 | 12.20 | 8.49 | 39.69 | 51.82 | 100.00 |
| 1994 | 18.68 | 18.99 | 31.69 | 8.61 | 12.70 | 9.33 | 37.67 | 53.00 | 100.00 |

(continued)

**Table 6.6 (continued)**

| Year | Categories of unrealized potential earnings | | | | | | Voluntary/involuntary unrealized potential earnings | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Unemployment | Illness | Housework | Voluntary | Retirement | Other | Involuntary | Voluntary | |
| 1995 | 18.09 | 20.03 | 30.72 | 8.77 | 12.94 | 9.45 | 38.12 | 52.43 | 100.00 |
| 1996 | 16.66 | 20.62 | 31.13 | 9.21 | 12.53 | 9.84 | 37.29 | 52.87 | 100.00 |
| 1997 | 15.26 | 20.98 | 31.02 | 9.64 | 14.03 | 9.06 | 36.25 | 54.70 | 100.00 |
| 1998 | 12.96 | 21.20 | 31.65 | 9.50 | 15.13 | 9.55 | 34.16 | 56.29 | 100.00 |
| 1999 | 12.09 | 21.86 | 31.76 | 9.64 | 15.07 | 9.58 | 33.95 | 56.47 | 100.00 |
| 2000 | 11.20 | 21.32 | 31.59 | 9.86 | 16.46 | 9.57 | 32.52 | 57.91 | 100.00 |

**Table 6.7 Per Capita Unrealized Potential Earnings, All Individuals, Total and by Category, 1975–2000 (2000 Dollars)**

| Year | Categories of unrealized potential earnings | | | | | | Voluntary/involuntary unrealized potential earnings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Unemployment | Illness | Housework | Voluntary | Retirement | Other | Involuntary | Voluntary | Total |
| 1975 | 1,824 | 1,369 | 4,918 | 568 | 426 | 714 | 3,193 | 5,913 | 9,820 |
| 1976 | 1,735 | 1,424 | 4,919 | 572 | 429 | 825 | 3,159 | 5,921 | 9,904 |
| 1977 | 1,459 | 1,378 | 4,799 | 579 | 542 | 891 | 2,837 | 5,920 | 9,649 |
| 1978 | 1,258 | 1,406 | 4,582 | 579 | 543 | 991 | 2,664 | 5,705 | 9,359 |
| 1979 | 1,285 | 1,455 | 4,465 | 559 | 565 | 914 | 2,739 | 5,588 | 9,241 |
| 1980 | 1,716 | 1,343 | 4,212 | 599 | 638 | 805 | 3,059 | 5,448 | 9,312 |
| 1981 | 1,956 | 1,340 | 3,995 | 642 | 693 | 818 | 3,296 | 5,331 | 9,444 |
| 1982 | 2,675 | 1,288 | 3,894 | 668 | 765 | 847 | 3,963 | 5,326 | 10,137 |
| 1983 | 2,505 | 1,313 | 3,783 | 683 | 833 | 755 | 3,818 | 5,299 | 9,872 |
| 1984 | 2,099 | 1,307 | 3,748 | 673 | 914 | 854 | 3,405 | 5,335 | 9,595 |
| 1985 | 1,900 | 1,294 | 3,545 | 690 | 924 | 902 | 3,195 | 5,158 | 9,254 |
| 1986 | 1,846 | 1,312 | 3,500 | 744 | 964 | 825 | 3,158 | 5,209 | 9,192 |
| 1987 | 1,686 | 1,388 | 3,533 | 769 | 1,021 | 818 | 3,074 | 5,323 | 9,215 |
| 1988 | 1,456 | 1,332 | 3,334 | 796 | 1,052 | 827 | 2,788 | 5,182 | 8,798 |
| 1989 | 1,405 | 1,375 | 3,290 | 781 | 948 | 606 | 2,780 | 5,019 | 8,405 |
| 1990 | 1,579 | 1,349 | 3,079 | 742 | 937 | 662 | 2,927 | 4,758 | 8,347 |
| 1991 | 1,985 | 1,357 | 2,996 | 746 | 905 | 648 | 3,342 | 4,648 | 8,638 |
| 1992 | 2,163 | 1,389 | 3,002 | 751 | 946 | 546 | 3,551 | 4,698 | 8,795 |
| 1993 | 1,939 | 1,570 | 2,751 | 752 | 1,079 | 750 | 3,509 | 4,582 | 8,841 |
| 1994 | 1,598 | 1,625 | 2,711 | 736 | 1,087 | 798 | 3,223 | 4,534 | 8,555 |

(continued)

**Table 6.7 (continued)**

| Year | Categories of unrealized potential earnings | | | | | | Voluntary/involuntary unrealized potential earnings | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Unemployment | Illness | Housework | Voluntary | Retirement | Other | Involuntary | Voluntary | |
| 1995 | 1,541 | 1,706 | 2,617 | 747 | 1,102 | 805 | 3,247 | 4,466 | 8,517 |
| 1996 | 1,406 | 1,740 | 2,626 | 777 | 1,057 | 830 | 3,146 | 4,461 | 8,437 |
| 1997 | 1,317 | 1,810 | 2,677 | 832 | 1,210 | 781 | 3,127 | 4,719 | 8,627 |
| 1998 | 1,123 | 1,837 | 2,742 | 823 | 1,311 | 827 | 2,959 | 4,876 | 8,662 |
| 1999 | 1,023 | 1,851 | 2,689 | 816 | 1,276 | 811 | 2,874 | 4,781 | 8,466 |
| 2000 | 964 | 1,835 | 2,718 | 849 | 1,416 | 823 | 2,799 | 4,983 | 8,606 |

**Table 6.8 Changes in Unrealized Potential Earnings, by Reason, 1975–2000**

| | Absolute change (billions 2000 dollars) | Per capita change (2000 dollars) | Relative change (percentage points) |
|---|---|---|---|
| Housework | | | |
| Men | +24 | +276 | +4.2 |
| Women | –151 | –4,391 | –26.3 |
| Unemployment | | | |
| Men | –44 | –1,303 | –19.4 |
| Women | –11 | –460 | –2.4 |
| Illness/disability | | | |
| Men | +67 | +307 | +5.0 |
| Women | +70 | +601 | +7.2 |
| Voluntary part-time work | | | |
| Men | +18 | +125 | +2.0 |
| Women | +52 | +438 | +5.4 |
| Retirement | | | |
| Men | +87 | +895 | +13.7 |
| Women | +91 | +1,071 | +10.4 |

# 7
# Earnings Capacity and Its Utilization for Race, Education, and Age Groups

## Levels and Trends, 1975–2000

In Chapter 6, we presented estimates of levels and time series trends of our EC indicator of the stock of human capital for the entire working-age population. Both aggregate and per capita patterns of EC were presented. We also explored the patterns of utilization of EC for the entire working-age population and for men and women in that population. Overall levels of utilization rose over the 1975–2000 period, largely because of the rapid increase in the allocation of human capital to market work by women. For men, utilization fell over time as an increased share of men chose to retire from work before age 65.

In this chapter, we explore these EC and utilization patterns for subgroups of the population distinguished by race, levels of schooling, and age. Do the patterns that we have discovered for the entire population hold for subgroups of the population distinguished by these characteristics? Have the trends in EC led to increased disparities among groups within these race, schooling or age categories, or has there been convergence in the levels or utilization of EC.

### AVERAGE EC AND CUR: RACIAL PATTERNS

Racial disparities in income and earnings between whites and nonwhites have long been of concern to both researchers and policymakers. Both have been regularly tracked and analyzed. However, earnings and income depend upon both the structure of opportunities and individual choices regarding work and work intensity. One advantage of

the EC concept is its independence from labor-supply choices, capturing as it does the earnings possibilities associated with individual human capital characteristics. In this section, we present patterns of EC over the 26-year period from 1975–2000 for whites and nonwhites; we also explore racial differences in the utilization of EC.

**Racial Patterns in Average EC**

Figure 7.1 presents the patterns of per capita EC for whites and nonwhites. In 1975, the average white had an EC of $32,700, compared with only $25,800 for the average nonwhite; the ratio of white to nonwhite EC was 1.27. Earnings capacity for both groups followed the population-wide recession/recovery pattern noted in Chapter 6. By 2000, whites averaged $42,700 in EC, an increase of 31 percent over the 26-year period. Nonwhites had attained an average EC of $30,400 by the end of the period, an increase of only 18 percent.

Noteworthy is the rapid recent increase in average EC for whites from 1993 to 2000 (17 percent), relative to the slow growth for nonwhites (11 percent). Figure 7.2 illustrates this pattern. From 1975 to 1991, the ratio of white EC to that for nonwhites rose slightly, beginning the period at 1.27 and ending it at 1.31. Starting in 1991, however, white EC increased rapidly, raising the white to nonwhite ratio to 1.40 by 2000.

Over the entire period, then, the racial gap in EC increased. Whites gained over their nonwhite peers, as the dollar gap between the two increased from $6,900 to $12,300, or by 79 percent. The ratio of white to nonwhite EC increased by over 10 percent over the period. This growth in racial differences in human capital is contrary to the narrowing of earnings differences among the races, suggesting increased utilization of human capital by nonwhites relative to whites over the period. Table 7.1 summarizes the pattern of racial changes in average EC from the beginning to the end of the period.[1]

**Racial Patterns in EC Utilization**

Figure 7.3 shows the patterns of utilization of human capital by racial group. At the beginning of the period—in the mid 1970s—whites were utilizing 63 percent of their EC, while the CUR of non-

**Figure 7.1 Per Capita EC, by Race**

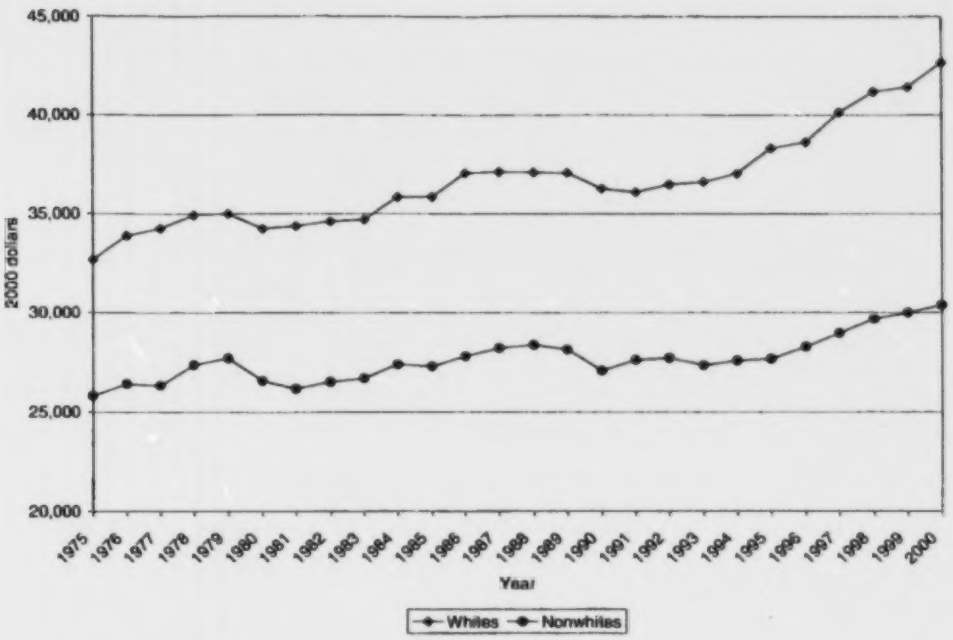



**Figure 7.2 Ratio of White to Nonwhite Per Capita, EC**

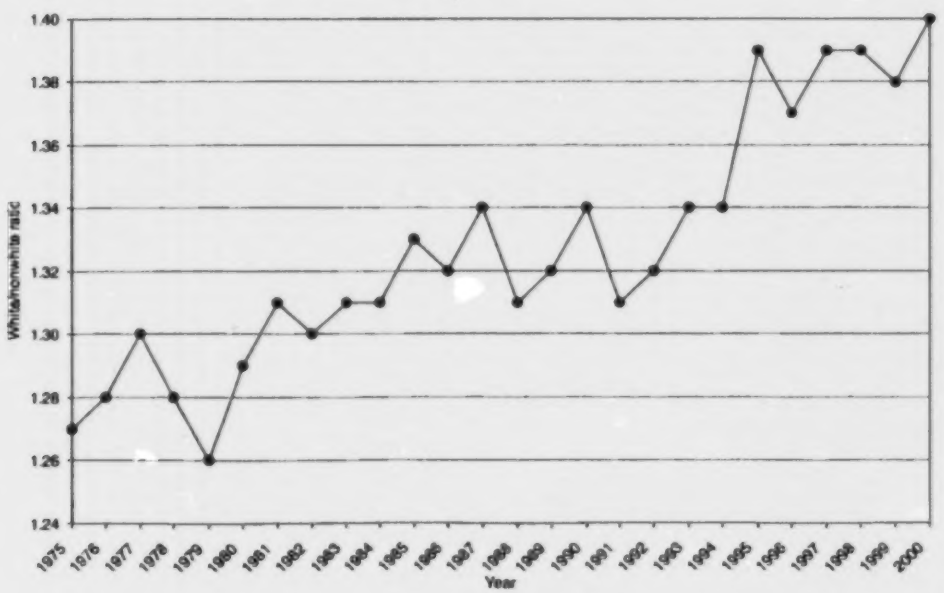
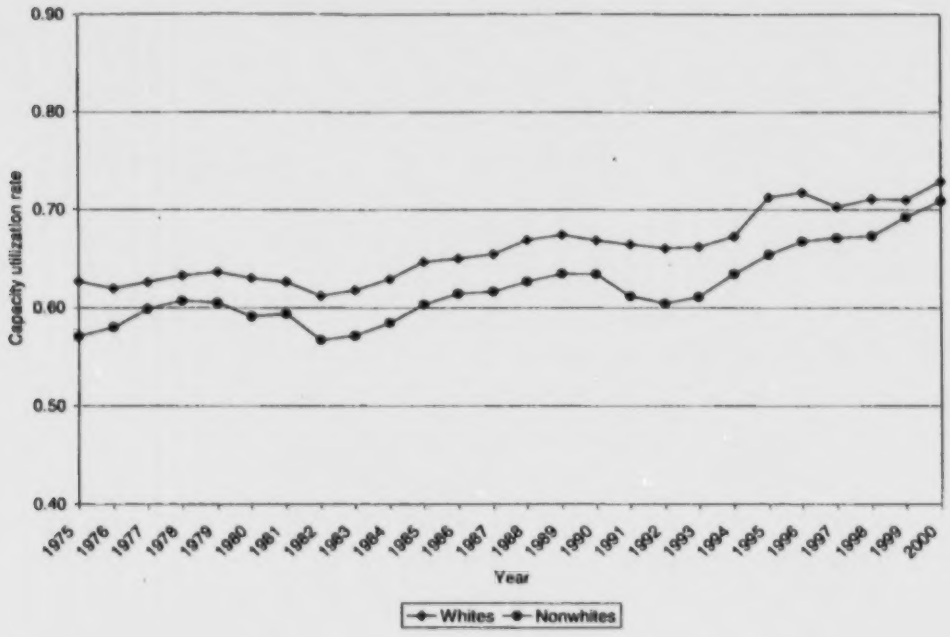


**Figure 7.3 Capacity Utilization Rates, by Race**



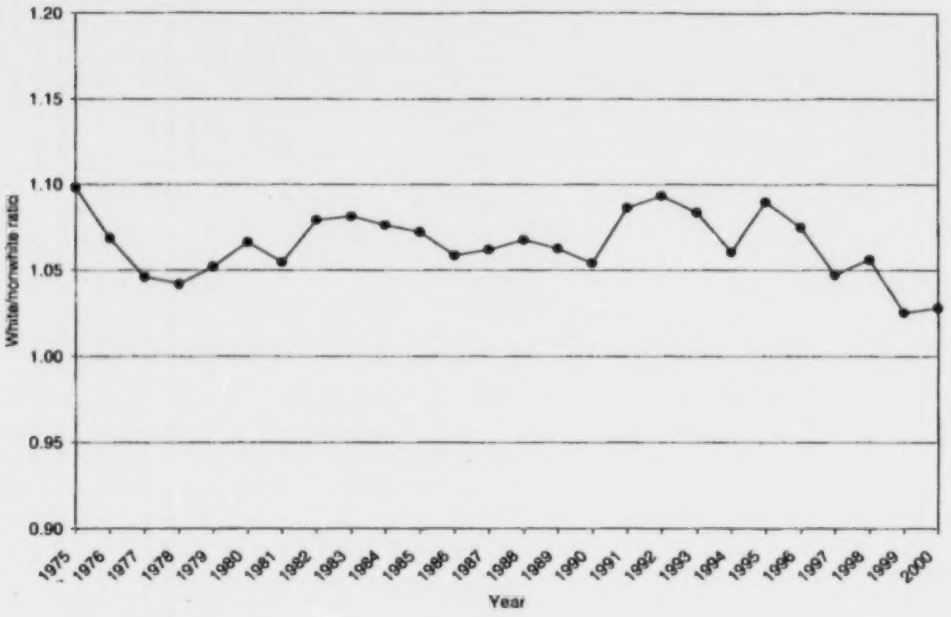

whites stood at about 57 percent. Over the 26-year period, both groups increased their utilization rates; the gain for whites was over 10 percentage points, while that for nonwhites was nearly 14 percentage points.

Both of the recessions over the 26-year period had a larger negative effect on capacity utilization of nonwhites than of whites. For example, while the recession of the early 1990s had a small effect of about one percentage point on the CUR of whites, the CUR of nonwhites fell by three percentage points.

Figure 7.4 indicates that the ratio of white to nonwhite capacity utilization has shown no real trend over the 1975–2000 period, although the final years of the period indicate a convergence in the two levels. Table 7.2 summarizes the levels and changes in racial capacity utilization patterns over the 1975–2000 period.[2]

The period of growth beginning in the early 1990s boosted the CUR of both whites and nonwhites, especially the latter. From its low of 0.60 percent in 1992, the CUR of nonwhites increased by 11 per-

**Figure 7.4 Ratio of White to Nonwhite CURs**




centage points by 2000; the white CUR increased by seven percentage points over this growth period.

In sum, then, racial gaps in EC were wide at the beginning of the period, and they expanded substantially over the subsequent 26 years. Whites also utilized a higher proportion of their human capital over the entire period, but the gap in utilization narrowed by the end of the period. By 2000, whites had a utilization rate only 3 percent (two percentage points) greater than that of nonwhites.

## AVERAGE EC AND CUR: SCHOOLING PATTERNS

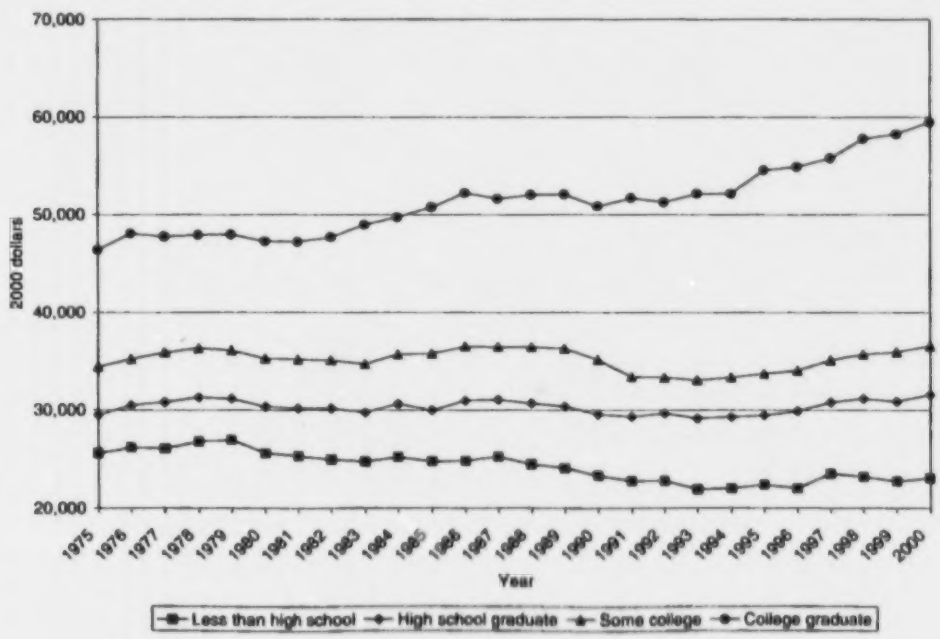
Differences in earnings and income among educational groups are yet other areas of economic disparity of interest to both researchers and policymakers. These differences are often taken to reflect the returns on schooling and, hence, the payoff for additional years of education. Again, earnings and income differences—hence, measures of the

return on schooling based upon them—depend upon both the opportunities available to individuals with different schooling levels and choices regarding work and work intensity that they make. In this section, we present evidence on the human capital returns associated with alternative schooling levels, abstracting from choices regarding the utilization of human capital. We also present evidence on the extent to which individuals with various levels of schooling utilize their EC.

## Schooling Patterns in Average EC

Figure 7.5 shows average human capital patterns for groups distinguished by years of completed schooling: high school dropouts, those with a high school degree, those with some college, and college graduates. Over the 1975–2000 period, average EC decreased by over $2,500 for those without a high school degree and increased by about $2,000 for high school graduates. Much larger changes are observed for those with at least some college education; for example, college graduates experienced an increase of about $13,000 over this period.

**Figure 7.5 Per Capita EC, by Education Level**

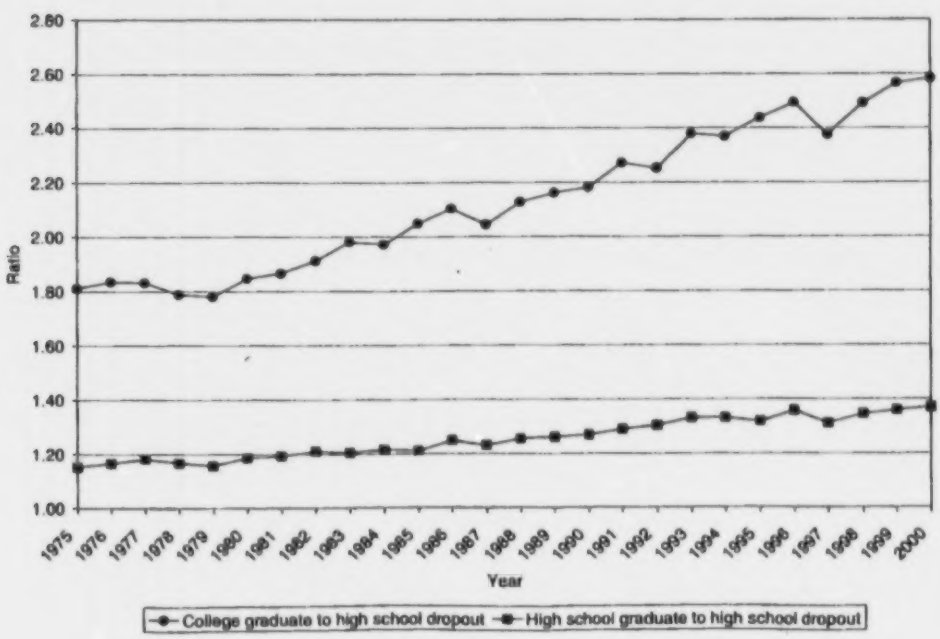


The increased gap between the highest and lowest of the trend lines in Figure 7.5 indicates the growing disparity in earnings opportunities—and, hence, human capital—among schooling groups. While the EC of college graduates increased about 28 percent over the period, that of high school dropouts fell by about 10 percent.

Figure 7.6 illustrates the erosion of earnings potential for those with little schooling. While the average high school graduate had earnings potential of about 115 percent of that of a high school dropout in 1975, this had risen to about 137 percent by 2000. The ratio of EC for college graduates to that of high school dropouts stood at about 1.8 in 1975; by 2000, it had increased to 2.6, an increase of over 42 percent.

Table 7.3 presents the 1975 and 2000 patterns in average EC among the various schooling groups (see also Appendix B). The gaps between the groups in both years are substantial and have increased significantly over the 1975–2000 period. The absolute gap in EC between college graduates and high school dropouts was about $21,000 in 1975; by 2000, the gap had increased to $36,500, or by 75

**Figure 7.6 Per Capita EC Ratios, by Education Level**



percent. The gap between high school graduates and dropouts more than doubled over the period.

## Schooling Patterns in EC Utilization

Figure 7.7 shows the patterns of human capital utilization for the four education groups. Human capital utilization increased for the three groups with the highest levels of schooling, but it remained at a distressingly low rate of less than 50 percent for those with less than a high school degree. By the end of the period, the utilization rate of dropouts was about two-thirds the level of utilization of the entire working-age population. Each of the two groups with schooling beyond high school increased their rate of utilization by more than 7 percent. Both groups had CURs that are well above the overall level in 2000.

While the two recessions had a very mild negative effect on utilization for the two schooling groups with some postsecondary education, those with a high school degree or less experienced substantial decreases in CUR during these periods. For example, during the recession of the early 1980s, the CUR of the high school dropouts fell from 48 percent to 43 percent. This low utilization rate failed to recover from this large drop during the remainder of the 1980s, falling to 41 percent during the recession of the early 1990s.

The period of rapid economic growth after 1992 had a substantial impact on the utilization rates of all of the education groups. The lowest skill group of high school dropouts was particularly affected during the period from 1992 to 2000. This group experienced an eight-percentage-point increase in its CUR (to 49 percent) by 2000. This was its highest level of human capital utilization since 1979.

Figure 7.8 compares the CUR of those without a high school degree to those with such a degree and those with at least a college degree. The figure shows that the CUR of both comparison groups rose relative to high school dropouts from the late 1970s through the early 1990s. The ratios of high school graduates' CUR to the dropouts' CUR rose from a low of 1.2 in 1976 to a high of 1.4 in the early 1990s. Because of the surge in utilization among high school dropouts in the period of rapid growth after 1992, the ratio ended the period in 2000 at about 1.3. Similarly, the CUR ratio of college graduates to high school



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**Figure 7.7 Capacity Utilization Rate, by Education Level**

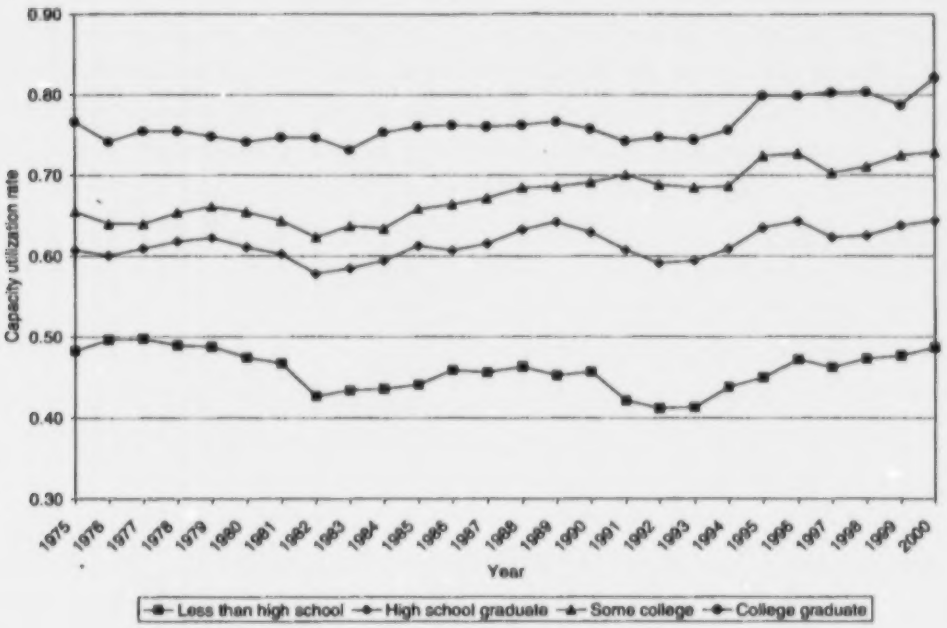
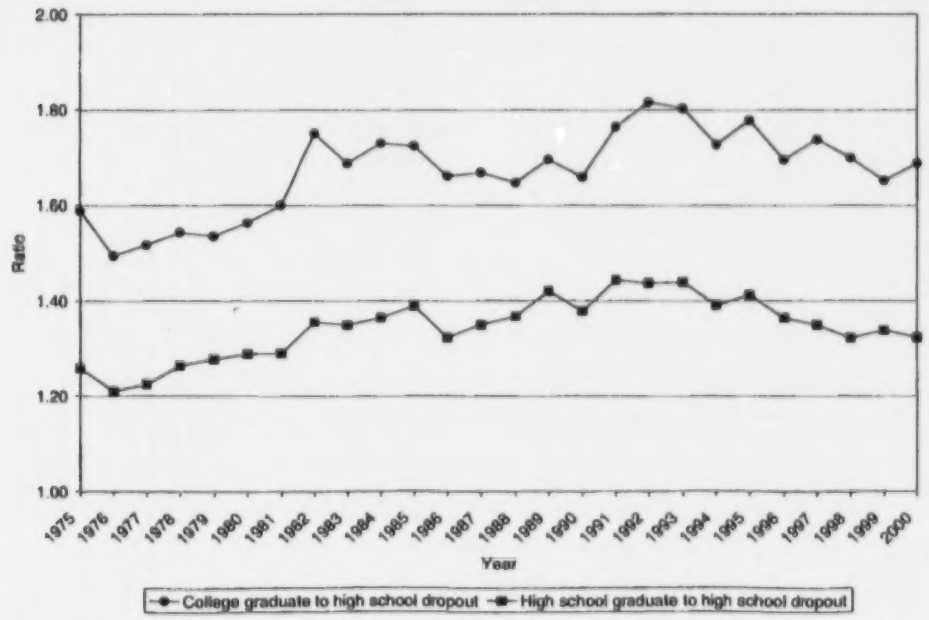



**Figure 7.8 Capacity Utilization Rate Ratios, by Education Level**





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dropouts rose from 1.5 to 1.8 over that same period, again drifting down during the 1990s to a 2000 ratio of 1.7.

These rather radical shifts in the CUR ratios are summarized in Table 7.4 (see also Appendix B). In both 1975 and 2000, the two higher schooling groups—those with some postsecondary school training—had CURs above the average for the working-age population. Conversely, the two groups with no more than a high school degree had CURs below the overall average. From 1975 to 2000, the utilization rates of high school dropouts remained constant. The other three groups enjoyed increases ranging from 6.0 to 11.3 percent.

Relative to high school dropouts, college graduates increased their capacity utilization over the period; the difference in utilization rates increased from 29 to 33 percentage points over the 26-year period, more than a 13 percent increase. The CUR ratio of college graduates to high school dropouts increased by more than 4 percent. While the utilization gaps and ratios were smaller for high school graduates relative to dropouts, they also increased over the period. In fact, the gap between the utilization rate of high school graduates and that of dropouts increased over 15 percent.

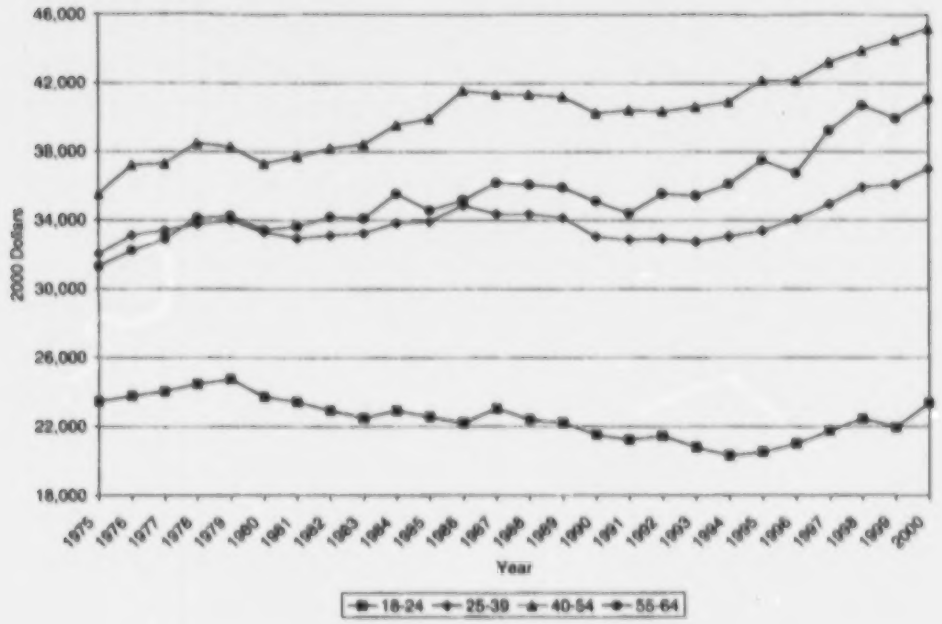
## AVERAGE EC AND CUR: AGE PATTERNS

The earnings and income of young workers relative to older workers has also deteriorated over the past several decades, and this change has also contributed to the growth of overall earnings and income inequality. Here we explore the changes in economic opportunities, as measured by EC, available to individuals of different ages.

### Age Patterns in Average EC

Figure 7.9 shows the pattern of per capita EC for various age groups. Substantial increases in EC are recorded for the two older age groups. Average EC for the group aged 25–39 showed no clear trend from 1975 to 1995, but then it increased by about $4,000, or by 9 percent over the remainder of the decade. The trend in EC for ages 18–24 was negative from 1975 to 1996, drifting down from about $23,400 to

**Figure 7.9 Per Capita EC, by Age Group**

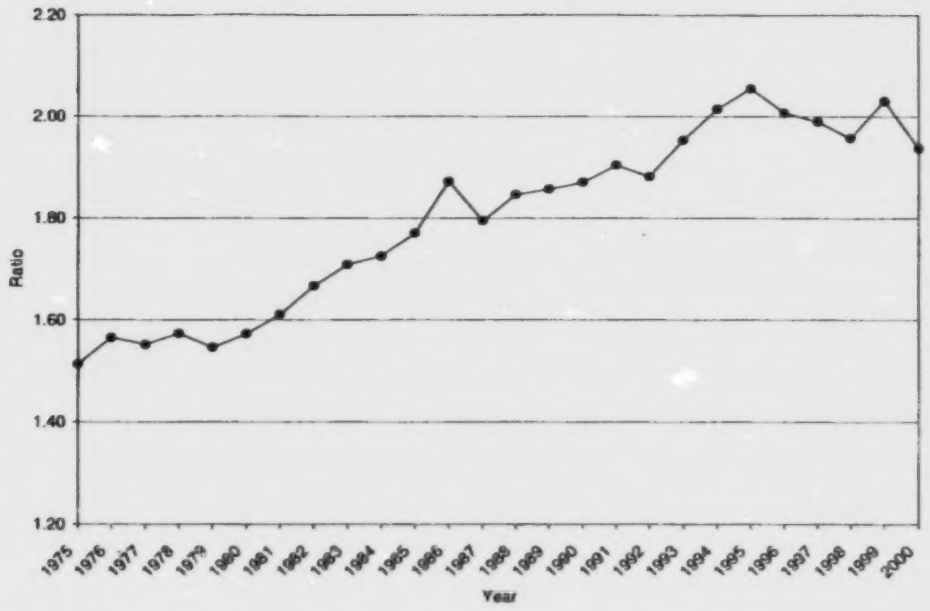



$21,000. Only after the expansion of the 1990s was well under way, did youths experience an increase in EC as youth EC increased by 15 percent from 1994 to 2000. The growing gap between the age groups is seen clearly in Figure 7.9—the gap between the average EC of those 40–54 and those 18–24 was $12,100 in 1975, but it had grown to $21,900 by 2000.

Figure 7.10 shows the 26-year trend in the EC ratio for middle-aged people (aged 40–54) to youths aged 18–24. In 1975, the ratio stood at 1.5, but it had increased to more than 2.0 by the mid 1990s, where it remained until the end of the decade. Nearly all of the increase occurred during the decade of the 1980s.

Table 7.5 indicates the growing age disparity in human capital over the period (see also Appendix B). In 1975, the group of youngest workers had EC equal to nearly three-fourths of that of the entire working-age population. However, this had fallen to about 60 percent by 2000. Workers aged 25–39 also saw the value of their human capital erode relative to the average over this period. Conversely, workers over age

**Figure 7.10 Per Capita EC Ratios, by Age Level (40–54 to 18–24)**

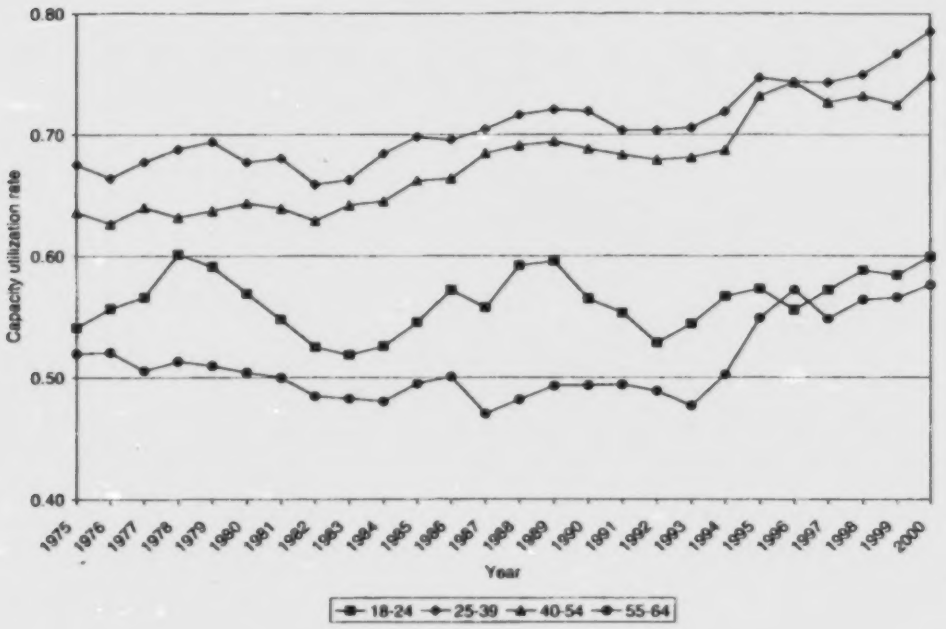



40 experienced increases in the value of EC of more than 25 percent over the period.

## Age Patterns in EC Utilization

Figure 7.11 shows the human capital utilization pattern of the various age groups. Over the entire period, the CUR for the two prime working-age groups (ages 25–54) ran at least 10 percentage points above that for younger and older workers. Moreover, over the 26-year period, the CURs of the two middle-aged groups increased by about 11 percentage points, while those of the younger and older age groups increased by about six percentage points. While the increase in utilization for the two prime working-age groups was rather steady throughout the period, that is not the case for younger and older workers. In both cases, utilization rates of younger and older workers tended to drift down from 1975 until the beginning of the decade of the 1990s. All of the growth in utilization for these groups has come during the recent growth period.

**Figure 7.11 Capacity Utilization Rates, by Age Group**

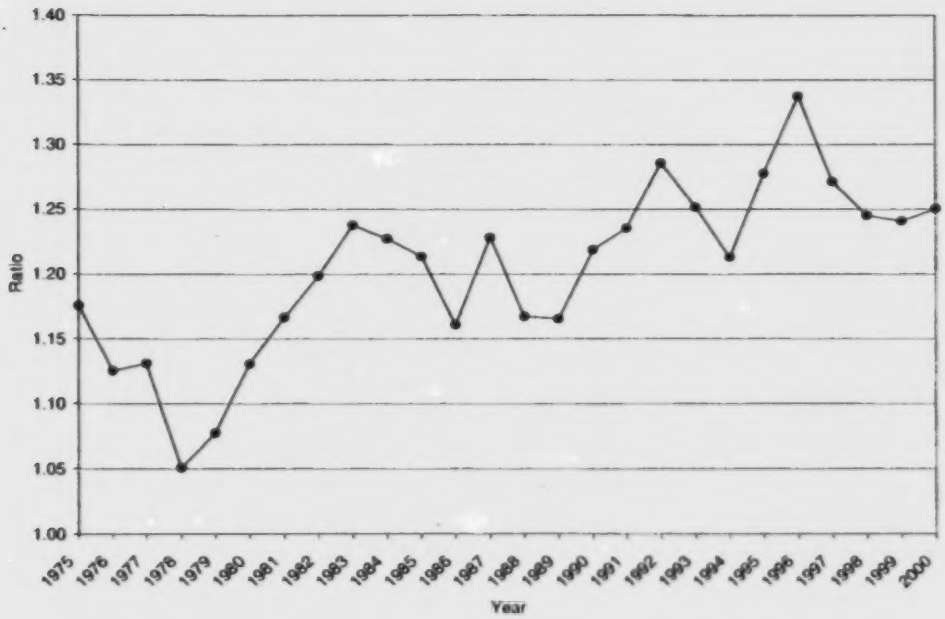



The recessions during the period had relatively small effects on all of the age groups, except people aged 18–24. The CUR of youths fell by seven to eight percentage points in each of the two recessions. Interestingly, while the prolonged recovery after the recession of the early 1990s led to increases in the CUR of all of the age groups, the largest impact was on the utilization of the human capital of the oldest groups; the CUR for the group of older workers increased from 48 percent in 1993 to 58 percent in 2000, an increase of 21 percent in this eight-year period.

Figure 7.12 shows the utilization patterns of prime-aged workers relative to youths. Youths made progress relative to prime-aged workers during the late 1970s; the CUR ratio fell from about 1.17 to 1.05 in just three years. However, the period since 1978 has seen youth CUR fall relative to the CUR of workers aged 40–54 years. By 1996, prime aged workers realized almost 35 percent more of their EC than did workers 18–24 years old.

Table 7.6 illustrates these age patterns in capacity utilization (see also Appendix B). While the utilization rates of all of the groups

**Figure 7.12 Capacity Utilization Rate Ratios, by Age Level (40–54 to 18–24)**




increased over the 1975–2000 period, those for the workers aged 25–54 increased by far more than those of older (aged 55–64) or younger (aged 18–24) workers. Substantial increases in utilization gaps among the age groups occurred over this 26-year period.

## SUMMARY AND CONCLUSIONS

We have used the EC indicator of human capital to explore within-group patterns in both the level of human capital and the utilization of human capital. We studied the gaps between high and low attainment groups in the race, schooling, and age dimensions.

By and large, the story is one of growing disparities in both the level and utilization of human capital over the 1975 to 2000 period. Within each of the racial, schooling, and age dimensions, the sub-groups with the lowest values of human capital—nonwhites, high

school graduates and dropouts, and young and old workers—experienced deterioration relative to subgroups with the highest values of these indicators. For high school dropouts and young workers, the real value of EC declined absolutely over the period. Among the subgroups that began the period with low levels of human capital, only nonwhites increased their EC over the period. Nevertheless, the gap in human capital between nonwhites and whites increased over the period.

Utilization patterns also differ within the race, schooling, and age dimensions over time. In only the schooling dimension, the group with the lowest human capital utilization rates—high school dropouts—experienced no increase in their capacity utilization rate. However, in both the schooling and age dimensions, the groups with the lowest utilization rates experienced declines in utilization relative to those groups with the highest utilization. Only in the racial dimension did the gap in human capital utilization close over the 1975–2000 period as nonwhites increased their rates of capacity utilization relative to those of whites.

In sum, then, gaps in human capital along racial, schooling, and age dimensions were wide at the beginning of the period and expanded substantially over the subsequent 26 years. With the exception of the racial dimension, gaps in the utilization of human capital also expanded over the period. In the racial dimension, the gap in utilization between whites and nonwhites fell during the 1975–2000 period and had nearly closed by the turn of the century.

## Notes

1. More detailed estimates of levels of and changes in average EC among racial, schooling, and age groups are found in the tables in Appendix B.
2. More detailed estimates of levels of and changes in capacity utilization patterns among racial, schooling, and age groups are found in the tables in Appendix B.

**Table 7.1 Changes in EC per Person among Racial Groups, 1975–2000 (Dollar Amounts in 2000 Dollars)**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | EC | Percent of population average EC | EC | Percent of population average EC | Change in EC (%) |
| White | 32,666 | 104 | 42,662 | 109 | +30.6 |
| Nonwhite | 25,809 | 82 | 30,365 | 78 | +17.7 |
| White minus nonwhite | 6,857 | | 12,297 | | +79.3 |
| Ratio of white to nonwhite | 1.27 | | 1.40 | | +10.2 |

**Table 7.2 Changes in EC Utilization among Racial Groups, 1975–2000**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | CUR (%) | Percent of population average CUR | CUR (%) | Percent of population average CUR | Change in CUR (%) |
| White | 63 | 101 | 73 | 101 | +15.9 |
| Nonwhite | 57 | 92 | 71 | 98 | +24.6 |
| White minus nonwhite | 6 points | | 2 points | | –66.7 |
| Ratio of white to nonwhite | 1.11 | | 1.03 | | –7.2 |

**Table 7.3 Changes in EC per Person among Education Groups, 1975–2000 (Dollar Amounts in 2000 Dollars)**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | EC | Percent of population average EC | EC | Percent of population average EC | Change in EC (%) |
| Schooling = <12 years | 25,612 | 81 | 23,035 | 59 | –10.1 |
| Schooling = 12 years | 29,531 | 94 | 31,552 | 81 | +6.8 |
| Schooling = 13–15 years | 34,468 | 109 | 36,558 | 93 | +6.1 |
| Schooling = 16 years or more | 46,396 | 147 | 59,468 | 152 | +28.2 |
| 16 years or more minus 12 years | 20,784 | | 36,433 | | +75.3 |
| Ratio of 16 years or more to <12 years | 1.81 | | 2.58 | | +43.1 |
| 12 years minus <12 years | 3,919 | | 8,517 | | +117.3 |
| Ratio of 12 years to <12 years | 1.15 | | 1.37 | | +19.1 |

**Table 7.4 Changes in EC Utilization among Education Groups, 1975–2000**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | CUR (%) | Percent of population average CUR | CUR (%) | Percent of population average CUR | Change in CUR (%) |
| Schooling = <12 years | 48 | 78 | 49 | 67 | 0.8 |
| Schooling = 12 years | 61 | 98 | 64 | 89 | 6.0 |
| Schooling = 13–15 years | 65 | 106 | 73 | 101 | 11.3 |
| Schooling = 16 years or more | 77 | 124 | 82 | 113 | 7.1 |
| 16 years or more minus <12 years | 29 points | | 33 points | | 13.7 |
| Ratio of 16 years or more to <12 years | 1.60 | | 1.67 | | 4.4 |
| 12 years minus <12 years | 13 points | | 15 points | | 15.4 |
| Ratio of 12 years to to <12 years | 1.27 | | 1.31 | | 3.1 |

**Table 7.5 Changes in EC per Person among Age Groups, 1975–2000 (Dollar Amounts in 2000 Dollars)**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | EC | Percent of population average EC | EC | Percent of population average EC | Change in EC (%) |
| Age 18–24 | 23,451 | 74 | 23,338 | 60 | –0.5 |
| Age 25–39 | 32,012 | 101 | 36,994 | 95 | +15.6 |
| Age 40–54 | 35,492 | 113 | 45,206 | 116 | +27.4 |
| Age 55–64 | 31,296 | 99 | 41,038 | 105 | +31.1 |
| Age 40–54 minus age 18–24 | 12,041 | | 21,868 | | +81.6 |
| Ratio of age 40–54 to age 18–24 | 1.51 | | 1.94 | | +28.5 |

**Table 7.6 Changes in EC Utilization among Age Groups, 1975–2000**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | CUR (%) | Percent of population average CUR | CUR (%) | Percent of population average CUR | Change in CUR (%) |
| Age 18–24 | 54 | 87 | 60 | 83 | +10.7 |
| Age 25–39 | 68 | 109 | 79 | 108 | +16.3 |
| Age 40–54 | 64 | 103 | 75 | 103 | +17.8 |
| Age 55–64 | 52 | 84 | 58 | 80 | +10.9 |
| Age 40–54 minus age 18 –24 | 10 points | | 15 points | | +50.0 |
| Ratio of age 40–54 to age 18–24 | 1.19 | | 1.25 | | +5.0 |

# 8
# Earnings Capacity and Its Utilization for Vulnerable Groups

## Levels and Trends, 1975–2000

The growing within-group gaps in both the level and utilization of human capital explored in Chapter 7 suggest that particularly vulnerable groups in the U.S. economy have fared badly over the last quarter of a century. To what extent has the EC of these vulnerable groups grown over time, both absolutely and relative to other working-age people? Have the levels of utilization of their human capital increased or decreased? In this chapter, we explore these questions.

While several particularly vulnerable groups could be identified, we focus on youths (ages 18–24) and older workers (ages 55–64) with low levels of educational attainment and skill—high school dropouts and high school graduates. Within these four low-education groups, we distinguish race and gender subgroups. We report levels and trends in both human capital and its utilization for these groups.

### THE LEVEL AND TREND OF HUMAN CAPITAL OF LOW-EDUCATION YOUTHS

Before describing trends in the utilization of human capital for youths with low schooling attainment, we examine the average EC levels they possess.

#### Earnings Capacity Levels of Low-Education Youths

In Table 8.1, the average EC is shown for each group. The period from 1975 through the early 1990s is distinguished from that in the recent years of rapid growth. Table 8.1 also shows the average EC



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level as a percentage of the average EC of all working-age people. By 2000, the average young female dropout who worked FTFY could earn slightly more than $15,000, which is less than 40 percent of the potential earnings of the average person of working age. Male youths who have failed to complete high school are estimated to have average EC of less than $21,000 in the year 2000, or about 53 percent of the EC of the average working-age person. While the potential earnings of high school graduates is somewhat higher, these levels are also very low in absolute value as well as relative to the average of the working-age population. These youths are a vulnerable population.

**Trends in EC of Low-Education Youths**

Figures 8.1 and 8.2 present trends in average EC for young men and women (ages 18–24) with a high school degree or less. For both groups, average EC eroded substantially over the 26-year period. For young male high school dropouts, EC fell from an already low level of $23,500 in 1975 to $16,900 by 1994. The reduction for high school graduates is also substantial but from a higher starting level. The situation is most severe for young women without a high school degree. In 1975, the average such a woman could expect to earn was $17,400 if she worked FTFY; by the mid 1990s, this had fallen to less than $13,300. The nation's economic growth during this period passed by these low education youth.[1] However, during the last one-half of the decade of the 1990s, the effects of the prolonged period of economic growth even trickled down to them; EC for male high school dropouts rose to nearly $21,000 and that for female dropouts to over $15,000.

Figure 8.3 shows the patterns for nonwhite youths who failed to complete high school. For the young men, EC dropped precipitously from $21,800 in 1975 to $16,300 by 1986—a drop of more than 25 percent. Since then, EC has remained nearly constant, with a substantial improvement after 1993.[2] From 1993 to 2000, EC increased from $15,700 to over $18,000, or by more than 15 percent.

For nonwhite young females, EC has also fallen, though in this case the erosion has been more persistent through the period.[3] The average EC of $18,100 in 1975 fell to less than $13,000 in the early 1990s. Like young nonwhite men, there has been some increase during the recent prosperity. By 2000, the EC of these young nonwhite low-

**Figure 8.1 Per Capita EC for 18- to 24-Year-Old, Low-Education Males**

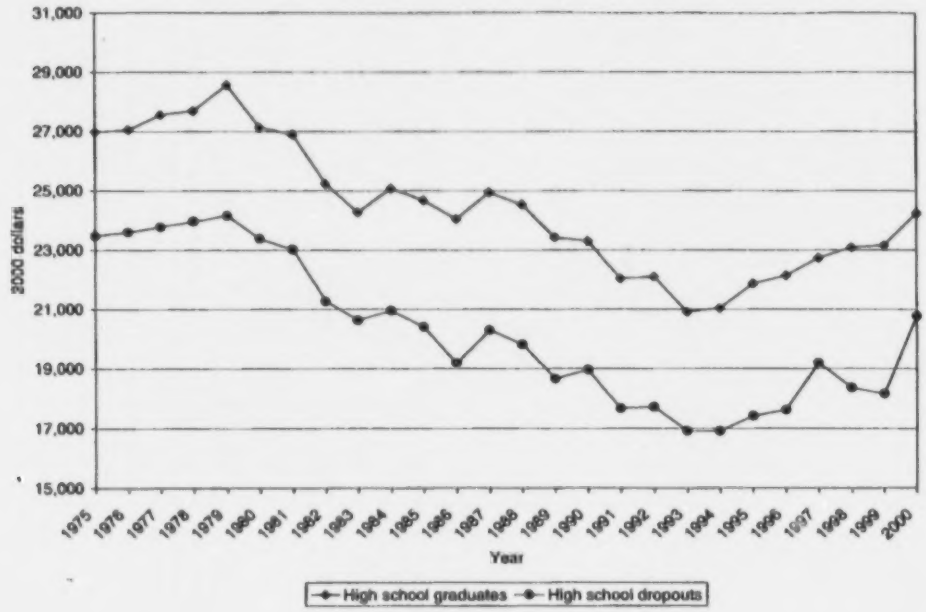


**Figure 8.2 Per Capita EC for 18- to 24-Year-Old, Low-Education Females**

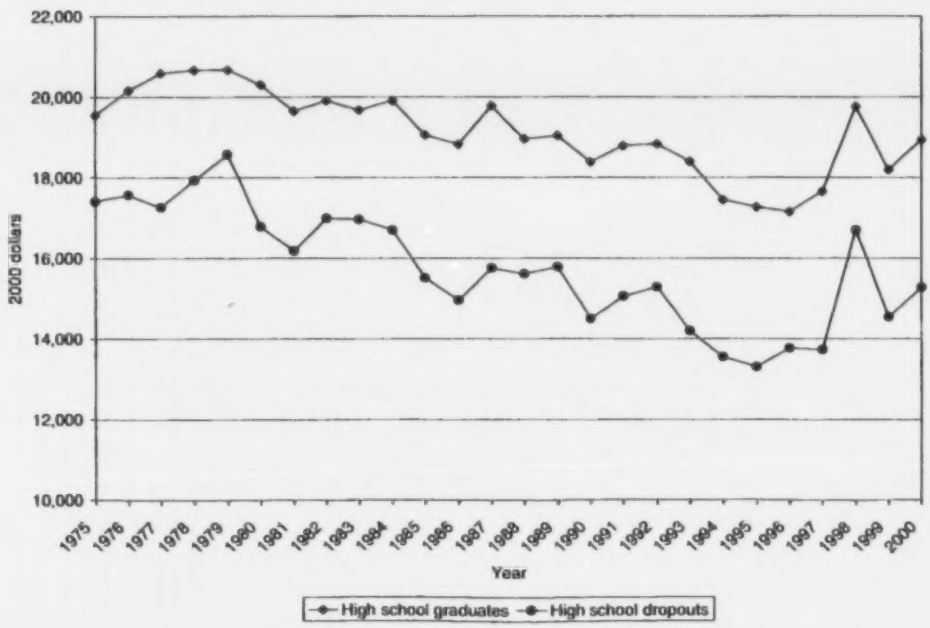


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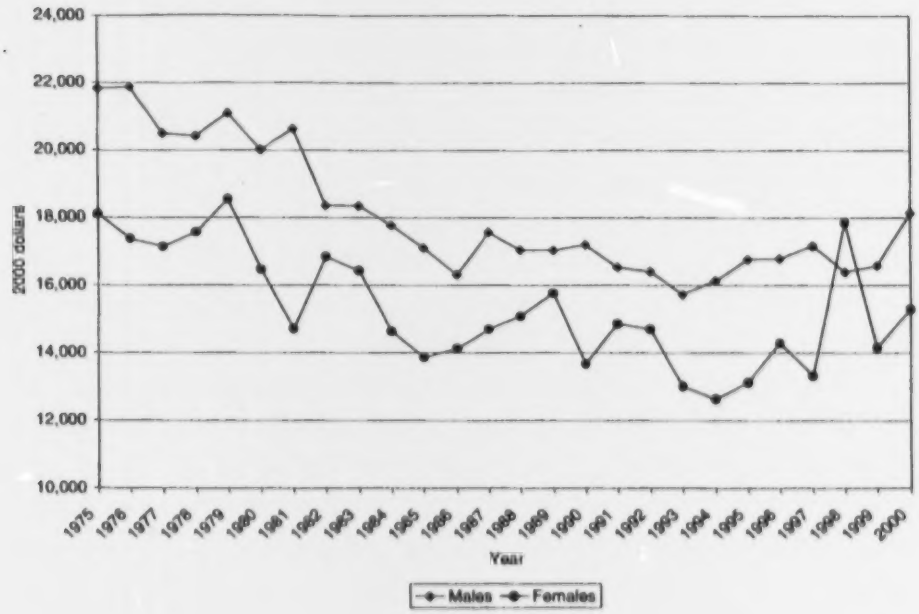
**Figure 8.3 Per Capita EC for 18- to 24-Year-Old, Nonwhite High School Dropouts**



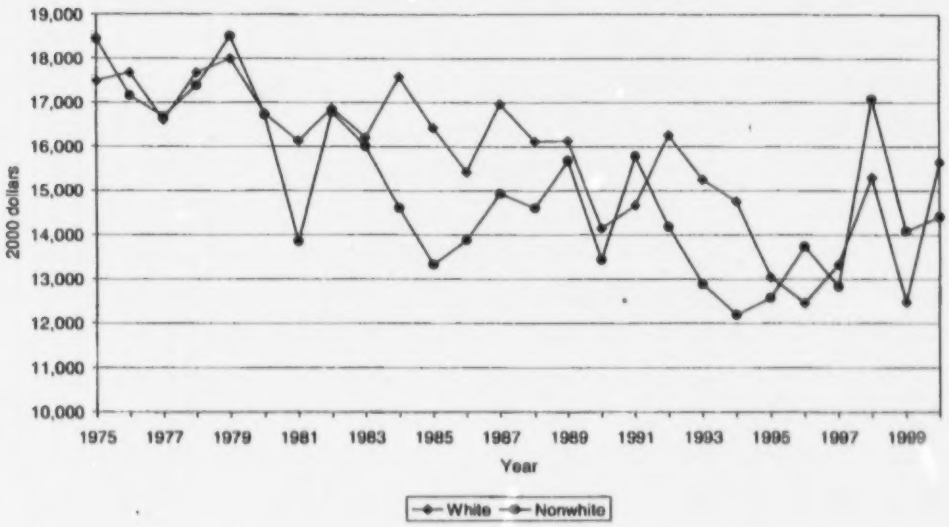

education women increased to $15,300, a gain of more than 21 percent since the low experienced in 1994. Clearly, these low-education nonwhite youths have fared even more poorly than low-skilled youths in general.

## Trends in EC of Low-Education Single Mothers

Figure 8.4 focuses on a subgroup of youths that have been and are the subject of both research and policy interest—young single females with children. Prior to 1996, these women were potentially eligible for public cash transfers through the nation's welfare system; since then they have been made the target of substantial efforts to increase work and self-reliance and to reduce dependence on public benefits. We distinguish both white and nonwhite young nonmarried mothers.

Both groups began the period with EC of about $18,000. Over the period, EC eroded for both racial groups. By 1995, the EC of both groups had fallen to less than $15,000. However, the prosperity of the recent period increased the EC of both groups. By 2000, the EC of all

**Figure 8.4 Per Capita EC for 18- to 24-Year-Old, Single, Female High School Dropouts with Children**




young nonmarried mothers stood at about $15,000. While the EC of the white mothers was above that of the nonwhites through most of the period, the racial gap between them was virtually eliminated by 2000.

## Overall Trends in EC of Low-Education Youths: A Summary

As Table 8.1 indicates, over the entire period, the largest decreases in EC are recorded by high school dropouts, especially nonwhite men and both white and nonwhite women. All of these groups experienced decreases of more than 11 percent in their ability to earn. In contrast, except for nonwhite men, high school graduates experienced much smaller losses. Women with a high school degree experienced smaller losses than their male counterparts. Perhaps the most vulnerable of the groups—young single unmarried mothers—saw 17 percent of their meager EC erode over the entire period, with that of nonwhite single mothers falling significantly more than that of whites.

For all of the vulnerable groups shown in the table, the period from 1975 to the early 1990s saw reductions in their capacity to earn, with all groups except white females experiencing reductions in excess of 18 percent. The sustained period of economic growth after the reces-

sion in the early 1990s benefited all of these groups. With the exception of white women, all have increases in EC over that period of at least 7 percent.

## THE LEVEL AND TREND OF HUMAN CAPITAL OF LOW-EDUCATION OLDER WORKERS

Earnings Capacity patterns for low-education older workers are summarized in Table 8.2. Again the period from 1975 to 1993 is distinguished from the period of rapid growth after 1993. Although older (ages 55–64) workers with low-education levels have higher average potential earnings than youths, the EC recorded for them is also well below that of the average EC of working-age people of their gender. For example, by 2000, older men without a high school degree had potential earnings of $27,700, or about 71 percent of that of the average working-age person. Similarly, the average older woman without a degree had an EC of only $20,200 in 2000, or about 52 percent of that of the average person of working age. These older, low-education people are also vulnerable workers.

Figures 8.5 and 8.6 show the pattern of average EC for older men and older women who are high school dropouts or have only a high school degree. In 1975, older male dropouts had potential earnings of about $32,700. Over the 1975–2000 period, the average EC of the older men dropped about $5,000 to $27,700. A similar eroding pattern exists for older men with a high school degree, but the decrease is not so severe.

For the older women, the levels of EC in 1975 are substantially below those of older men with equivalent schooling. For example, while the potential earnings of male high school dropouts was $32,700 in 1975, their female counterparts had an EC of about $18,100. The gap between them was nearly $15,000. However, over the period, the EC of older low-education women increased as compared with the erosion of EC for older men. The $15,000 gap between them in 1975 had fallen to about $7,000 by 2000. A similar erosion of the gender EC gap exists for those with a high school degree.

**Figure 8.5 Per Capita EC for 55- to 64-Year-Old, Low-Education Males**

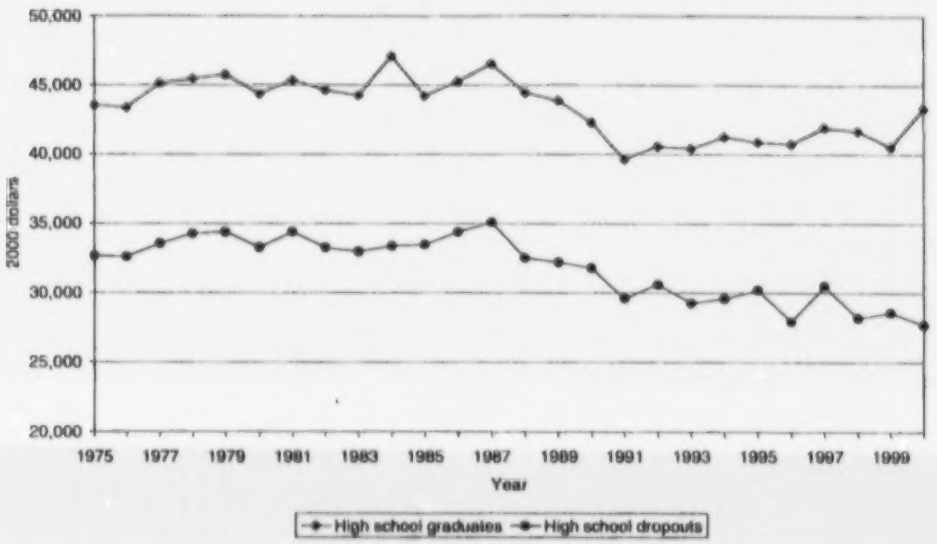



**Figure 8.6 Per Capita EC for 55- to 64-Year-Old, Low-Education Females**

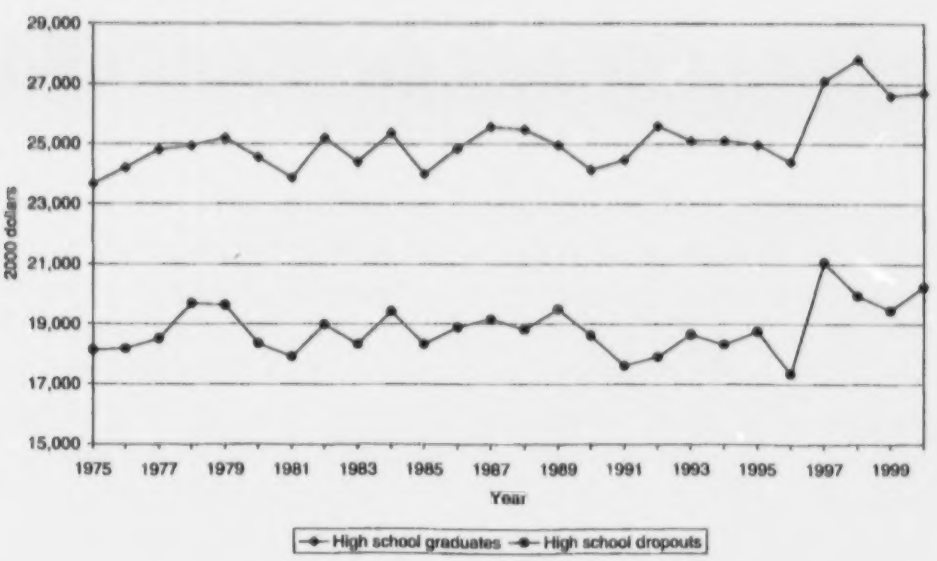





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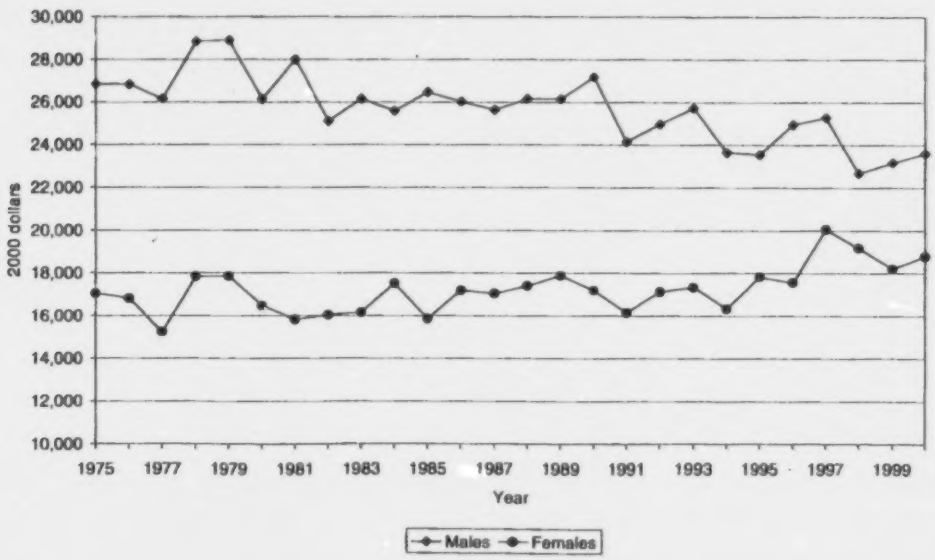
Figure 8.7 shows the pattern for nonwhite older high school dropouts. Both gender groups began the period with substantially lower levels of EC than did their white counterparts. For example, older white male dropouts had an EC of $34,000 in 1975, compared with the nonwhite EC of $26,800. Over the period, the EC of low-education older nonwhite men fell, while that of older low-education nonwhite women rose, paralleling the patterns seen in Figures 8.5 and 8.6.

However, relative to white older men with low education, nonwhite men fared badly over this 26-year period. While the EC of older white male dropouts fell by about 9 percent over the period, that for older nonwhite male dropouts fell by 12 percent. Unlike the pattern for some of the other groups studied, the prosperity of the recent period appears to have had a very small effect on the EC of these male groups.

Unlike the males, nontrivial gains in average EC are recorded for the older nonwhite women dropouts. Moreover, again unlike the older low-education men, the recovery period after the early 1990s led to substantial gains in EC for these low-education older nonwhite women.

As with young, low-education workers, older workers with low levels of schooling also fared relatively poorly during the 1975–1993 period, especially in the first 15 or so years of the period. During the

**Figure 8.7 Per Capita EC for 55- to 64-Year-Old, Nonwhite High School Dropouts**



period from 1975 to the early 1990s, older male dropouts saw EC decreases of 9 percent for whites and 4 percent for nonwhites. Older male workers with a high school degree also experienced a substantial erosion in EC over this period. As with the low-education youth, low-skilled older workers experienced some benefit from the economic recovery experienced after the early 1990s. During this period of prosperity, older low-education nonwhite women (both dropouts and graduates) experienced increases in earnings capacity of almost 9 percent; the gains for low-education older men were much smaller.

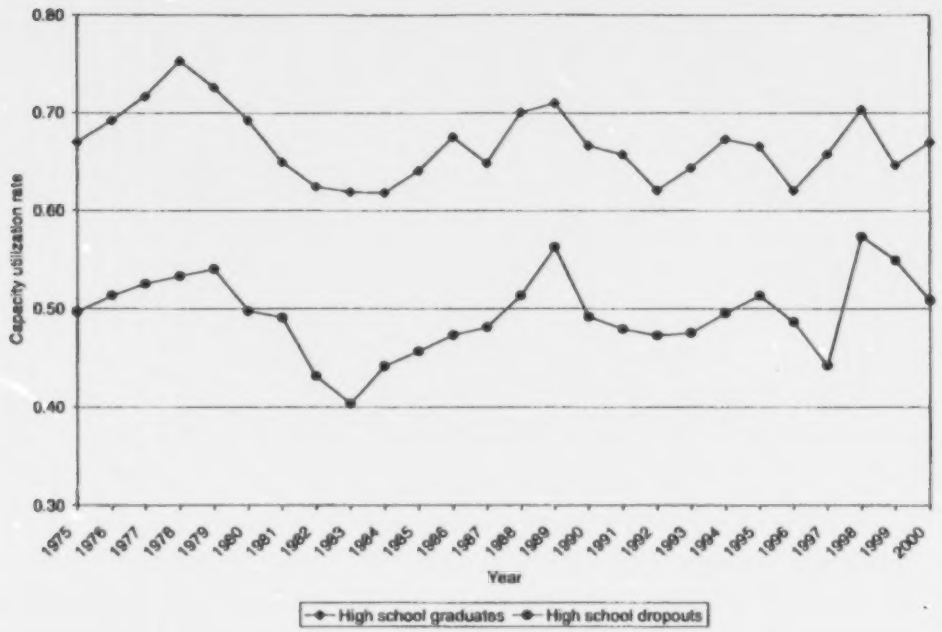
## CAPACITY UTILIZATION PATTERNS AMONG LOW-EDUCATION YOUTHS

The patterns observed in Chapter 7 indicate that in 2000, the most vulnerable socioeconomic groups in the nation—nonwhites, youths, and those with low education—have lower rates of capacity utilization than do less vulnerable groups. Moreover, the utilization gaps between younger and older working-age people and those among schooling groups have been increasing over time. Here, we explore the patterns for the particularly vulnerable groups identified above—youths and older workers with low education (high school dropouts and those with just 12 years of schooling). We calculate the levels and trends in the utilization of human capital for racial and gender groups within these low-schooling categories.

### Low-Education Young Men

Figure 8.8 presents the trend in human capital utilization for the group of young men (ages 18–24) with a high school degree or less. For both low-education groups, CUR eroded over the 26-year period, after rising in the late 1970s. By 2000, young male high school graduates had a CUR of 67 percent, while young high school dropouts were utilizing only 51 percent of their human capital. The recession of the early 1980s reduced the CURs of both groups substantially—for high school dropouts, for example, the CUR fell from 54 percent to 40 percent from 1979 to 1983. While the recession of the early 1990s

**Figure 8.8 Capacity Utilization Rate for 18- to 24-Year-Old, Low-Education Males**

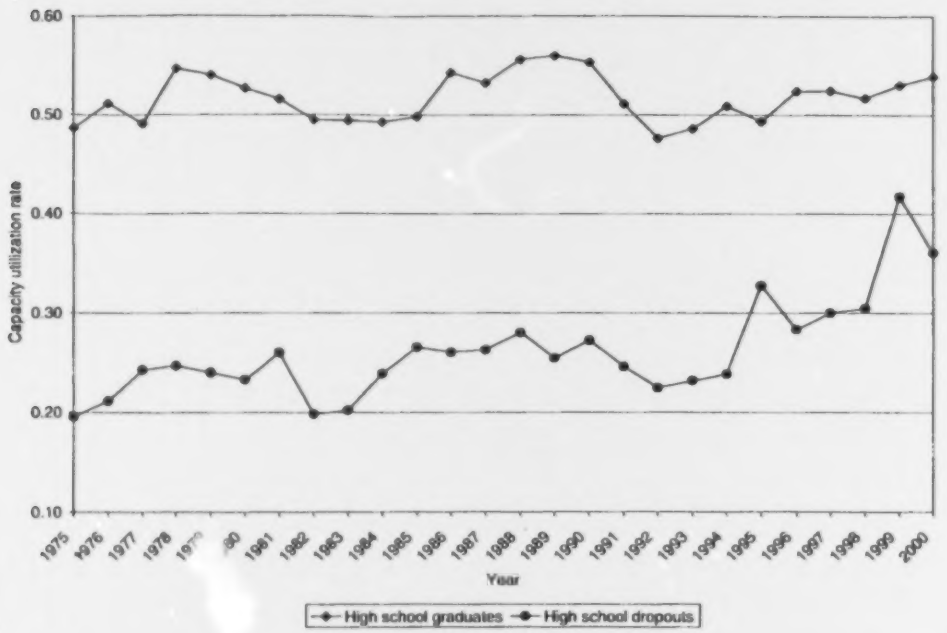



adversely affected both groups, its impact was much smaller than the recession of the prior decade. Interestingly, the prolonged growth period after 1992 had very little effect on the CUR of these low-education young men.

## Low-Education Young Women

The pattern for young women with low levels of schooling is shown in Figure 8.9. While the CUR of young women with a high school degree increased slightly from a modest base of 49 percent, that of young female high school dropouts rose from a very low level of 20 percent to about 36 percent. The growth period beginning in the early 1990s is associated with a small increase in CUR of five percentage points for high school graduates but a substantial increase of 14 percentage points for high school dropouts. While low-education young women also experienced adverse effects of recessions, their losses in both the early 1980s and the early 1990s were small compared with the low-education males.

**Figure 8.9 Capacity Utilization Rate for 18- to 24-Year-Old, Low-Education Females**

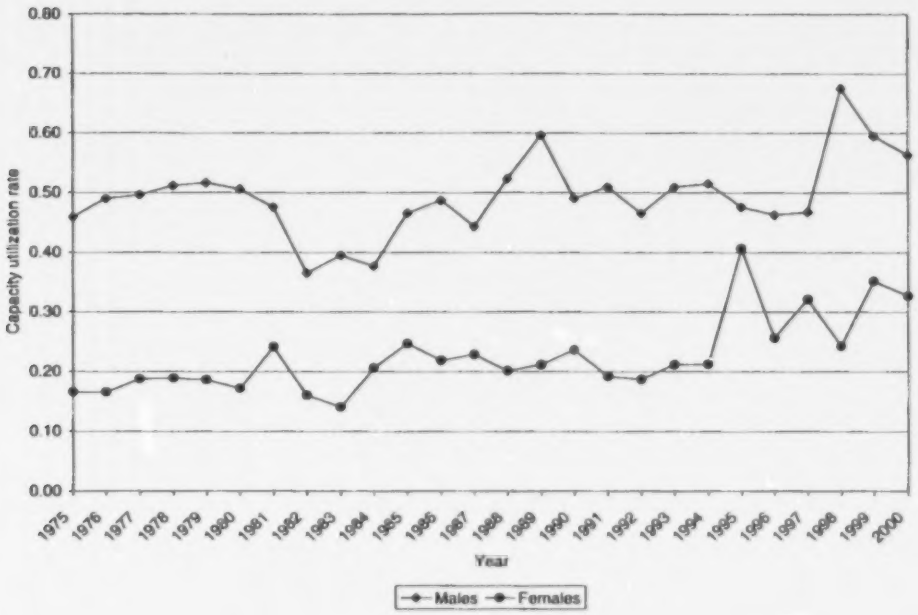



## Young Men and Women Dropouts

Figure 8.10 compares the utilization patterns of two groups of substantial policy interest: young nonwhite male and female high school dropouts. The two recessions had a major effect on the utilization of the human capital of young nonwhite male dropouts. From 1979 to 1982, for example, the CUR of this group fell from 52 percent to 37 percent, a drop of about 29 percent. During the recession of the early 1990s, their CUR fell from its high of 60 percent in 1989 to 47 percent in 1992, a fall of 22 percent. The prolonged prosperity increased their utilization of human capital from the 47 percent figure to 54 percent by 2000.

For young nonwhite low-education women, the situation is quite different. The recessions had a less severe effect on their very low level of human capital utilization—from 19 percent in 1979 to 16 percent in 1982, and from 21 percent in 1989 to 19 percent in 1992. However, the sustained period of growth after 1992 is associated with a major

**Figure 8.10 Capacity Utilization Rate for 18- to 24-Year-Old, Nonwhite High School Dropouts**



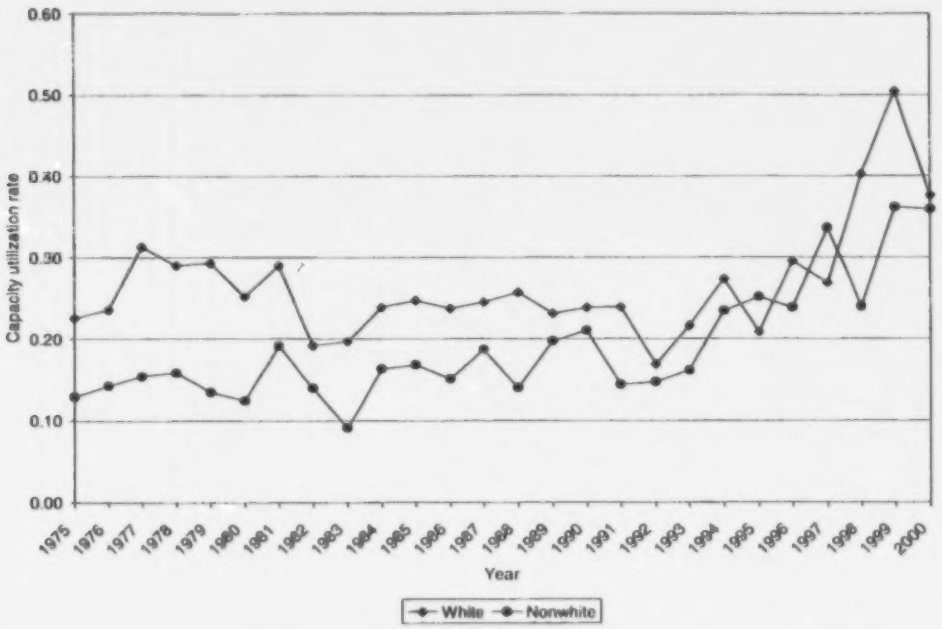

increase in the CUR of this group. From its low of 19 percent in 1992, the sustained prosperity of recent years together with the radical changes in welfare policy that occurred simultaneously, pushed the CUR of these young nonwhite women to 33 percent by 2000, an increase of 74 percent!

### Young Welfare-Eligible Women with Children

Figure 8.11 isolates the levels and trends of the group of welfare-eligible young women with children, who have been subject to so much policy interest in recent years. For the two racial groups, the levels of human capital utilization were extremely low from 1975 through the 1980s, ranging from about 10 to 20 percent for nonwhites and 20 to 30 percent for whites over the period. In the recession year of 1992, the rates for both racial groups had fallen to the 15–17 percent range.

However, in the subsequent years of sustained prosperity, the rates for both groups soared, stimulated by both the economy and the major emphasis on work that pervaded welfare policy during this period. By

**Figure 8.11 Capacity Utilization Rate for 18- to 24-Year-Old, Single, Female High School Dropouts with Children**




2000, the CURs of young white and nonwhite, low-education, single females with children had risen to nearly 38 percent, well over twice their levels in 1992. These gains are unprecedented and reflect the effect of the economic recovery on this group of young women, as well as the strong welfare-to-work emphasis of welfare reform efforts occurring during this period.

## Capacity Utilization Patterns among Low-Education Youths: A Summary

Table 8.3 summarizes these changing CUR patterns for youths, distinguishing the period from 1975 through the early 1990s from the subsequent recovery after the recession at the start of the decade. The experiences of these vulnerable youths between the two subperiods were quite different.

The early period of our analysis (1975–early 1990s) witnessed increases in CUR for females, but decreases for low-education males, except for nonwhite high school dropouts. Female high school drop-

outs and the subgroup of nonwhite female high school dropouts enjoyed increases in CUR of over 19 percent. Those with more barriers to employment (e.g., single mothers) did not experience such increases in CUR. For example, single women with children recorded only a 5 percent increase in CUR in this early period, although nonwhite single women saw their rate of capacity utilization rise from 13 percent to 16 percent. Most of the other groups in Table 8.3 saw small positive or negative changes in CUR.

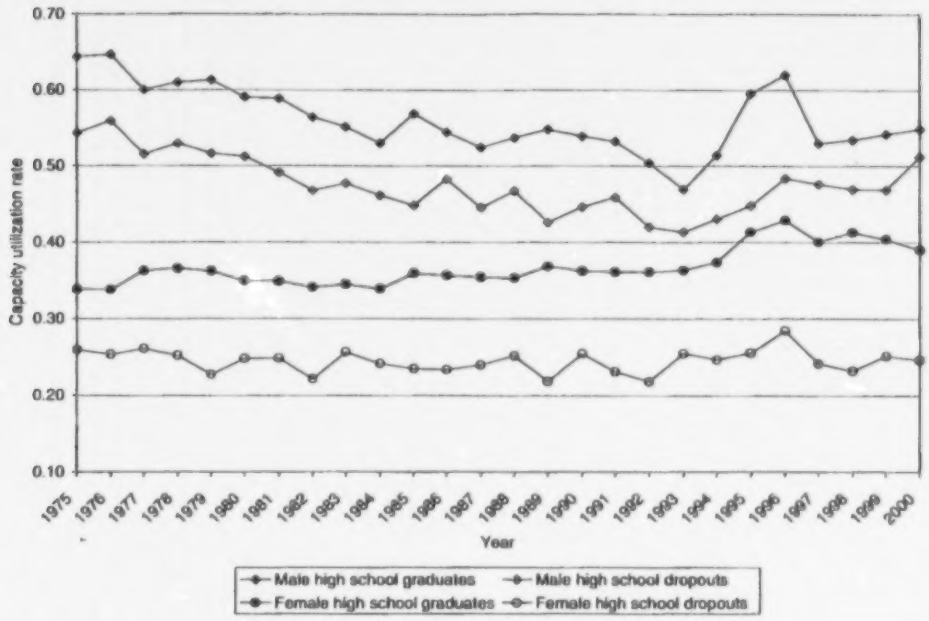
Our story changes dramatically when we turn to the later period, the early 1990s to 2000. Every subgroup enjoyed an increase in CUR. The CUR of single nonwhite women with children more than doubled over this short period, rising from 16 percent to 36 percent. In fact, all subgroups of women, except white high school graduates, recorded increases in CUR of over 20 percent, with higher percentage increases observed for high school dropouts than for graduates. The rapidly growing economy, combined with welfare reform efforts, appears to have brought substantial numbers of young women with low education into employment. The robust economy also helped young nonwhite men with low levels of schooling enjoy at least small increases in utilization over this period.

While these gains in utilization are impressive, the rather low level of the CURs of these groups at the end of the period should not be overlooked. None of the dropout groups except nonwhite men had utilization rates as high as 50 percent, with the rates for women remaining at or below about 40 percent. Only young men with a high school degree recorded a CUR in 2000 that approached the nation's overall rate of utilization of 72 percent.

## CAPACITY UTILIZATION PATTERNS AMONG LOW-EDUCATION OLDER WORKERS

Table 8.4 summarizes the patterns of capacity utilization for older working-age people, again distinguishing the period from 1975 to the early 1990s from the subsequent period of rapid economic growth. Figure 8.12 presents capacity utilization patterns for older (ages 55–64) men and women who are either high school dropouts or have only a

**Figure 8.12 Capacity Utilization Rate for 55- to 64-Year-Old, Low-Education Males and Females**




high school degree. These older groups have among the lowest levels of potential earnings in the nation and are particularly vulnerable in the labor market.

The older low-education men have a substantially higher overall CUR than the women. For high school dropouts in 1975, the male CUR was 54 percent compared with the female CUR of 26 percent. For high school graduates, the two comparable rates were 64 percent and 34 percent. As is seen in the figure, the gender gap among the high school graduates had narrowed substantially by 2000, as the utilization rates for older male graduates drifted down over the period, while those of the older female graduates rose slightly. Utilization rates for both male and female dropouts remained relatively constant over the period.

Consider, first, the pattern of change for the 1975–1993 period. For men, both older nonwhite and older white dropouts saw large decreases in CUR, ranging up to 26 percent for whites. Sizable decreases in CUR are recorded for the older male high school graduates as well, with an

overall decrease of 27 percent. All of the older male categories shown in the table had decreases in CUR of more than four percentage points. While older women dropouts recorded a slow erosion in capacity utilization from 1975 to 1993, those with a high school degree actually increased their utilization slightly over this period.

The most interesting story of Table 8.4 is the strong impact of the recovery from the recession of the early-1990s on the human capital utilization of this group of older, low-education men.[4] During that prolonged postrecession prosperity, rather complete reversals in the utilization of human capital occurred for these low-skilled older men. For male dropouts, the CUR rose from 41 percent in 1993 to 51 percent by 2000, an increase of 24 percent. The CUR for high school graduates increased from 47 percent to 55 percent, or by 17 percent.

Clearly, this older, low-education male group has been a key marginal group during the past quarter of a century in the nation. As the labor market eroded during the period from the mid 1970s to the early 1990s, their rates of human capital utilization dropped rapidly. However, substantial increases in their human capital utilization have occurred in the recent prolonged expansion. For low-education older women, much smaller increases in capacity utilization were recorded during the 1990s.

## SUMMARY AND CONCLUSIONS

The patterns of large and growing gaps in human capital within race, schooling, and age groups identified in Chapter 7 become exaggerated when particularly vulnerable groups of the population are studied.

Consider, first, levels and trends in human capital among low-education youth. Among both young men and women with low levels of schooling, EC at the beginning of the period was very low—about $23,500 for young men without a high school degree and less than $17,500 for young women who had dropped out. By the end of the period, human capital for both groups had fallen—to below $21,000 for young men and to about $15,000 for young women who had failed to complete high school. If these youths were nonwhite males, or if

they were single women with children, their earnings potential by 2000 had fallen to even lower levels.

Most of this decrease in the value of human capital occurred between 1975 and the early 1990s, with reductions in EC of between 10 and 30 percent among the high school dropout groups that we have distinguished. However, after the recession of the early 1990s, all of these groups of young males with a high school degree or less experienced substantial increases in EC, ranging from 7 to 34 percent. Smaller gains were recorded for low-education women during this robust growth period, and those were concentrated among nonwhite women.

Among all of the groups of low-education youths that we distinguished, capacity utilization levels were very low. Among young dropouts in 1975, CURs ranged from 13 percent for single nonwhite women with children to 46 percent for nonwhite men. From 1975 through the early 1990s, there was a small decrease in utilization levels for young men without a high school degree, while utilization for young female dropouts increased about 17–28 percent (except those who were single with children). The main story is the striking growth in capacity utilization levels from the recession of the early 1990s until 2000 for young low-education women, especially nonwhite young women and single young women with children. For example, nonwhite female dropouts increased their utilization rate by 64 percent over this period, and young single women with children doubled their rate of human capital utilization.

Among older workers without a high school degree, levels of EC are also low—ranging from about $19,000 for nonwhite older females to $31,000 for white male dropouts in 2000. Decreases in human capital are recorded over the entire 26-year period for both male dropouts and high school graduates, with larger decreases for dropouts; increases of from 10–15 percent are recorded for the groups of low-education women. During the growth period after 1993, EC levels continued to erode for male dropouts, but they increased for all of the other groups of older workers. In terms of capacity utilization, the period after the recession of the early 1990s was particularly supportive for the groups of older, low-education men. This period of growth, however, did not affect older, low-education women, and virtually no increase in their utilization rates is observed since 1993.

## Notes

1. For females, the gap in EC between these two low-education groups increased over the period; for males, the gap between the two groups remained nearly constant. Interestingly, for both male dropouts and high school graduates, a substantial increase in average EC is observed in the several years since the recession of the early 1990s. However, this period of robust economic and productivity growth has had a much smaller effect on female dropouts or those with a high school degree.
2. While both white and nonwhite young males shared in the increasing real wage environment of the period since about 1992, the gains were much larger for white youths relative to nonwhites.
3. Young nonwhite female dropouts experienced a 16 percent decrease in average EC over the period, while young white female dropouts saw their earnings potential fall by about 11 percent.
4. This pattern for men is consistent with estimates of Quinn (2000), suggesting that the long trend of increasing early retirement of low-education men tapered off or ended in the mid 1990s.

**Table 8.1 Patterns of Earnings Capacity Per Person among Low-Education Youths, 1975–2000 (Dollar Amounts in 2000 Dollars)**

| | 1975 | | 1993 | | 2000 | | Change in EC per person (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | EC | Percent of population average EC | EC | Percent of population average EC | EC | Percent of population average EC | 1975–1993 | 1993–2000 | 1975–2000 |
| Total working-age population | 31,541 | 100.0 | 34,287 | 100.0 | 39,138 | 100.0 | 8.7 | 14.1 | 24.1 |
| High school dropouts | | | | | | | | | |
| Men | 23,470 | 74.4 | 16,915 | 49.3 | 20,781 | 53.1 | –27.9 | 22.9 | –11.5 |
| Whites | 24,208 | 76.8 | 17,884 | 52.2 | 23,920 | 61.1 | –26.1 | 33.7 | –1.2 |
| Nonwhites | 21,821 | 69.2 | 15,718 | 45.8 | 18,143 | 46.4 | –28.0 | 15.4 | –16.9 |
| Women | 17,410 | 55.2 | 14,193 | 41.4 | 15,271 | 39.0 | –18.5 | 7.6 | –12.3 |
| Whites | 17,056 | 54.1 | 15,307 | 44.6 | 15,252 | 39.0 | –10.3 | –0.4 | –10.6 |
| Nonwhites | 18,101 | 57.4 | 13,007 | 37.9 | 15,285 | 39.1 | –28.1 | 17.5 | –15.6 |
| Single women with children | 17,951 | 56.9 | 13,918 | 40.6 | 14,910 | 38.1 | –22.5 | 7.1 | –16.9 |
| Whites | 17,491 | 55.5 | 15,253 | 44.5 | 15,646 | 40.0 | –12.8 | 2.6 | –10.6 |
| Nonwhites | 18,447 | 58.5 | 12,886 | 37.6 | 14,409 | 36.8 | –30.1 | 11.8 | –21.9 |
| High school graduates | | | | | | | | | |
| Men | 26,973 | 85.5 | 20,909 | 61.0 | 24,239 | 61.9 | –22.5 | 15.9 | –10.1 |
| Whites | 27,423 | 86.9 | 21,237 | 61.9 | 25,575 | 65.3 | –22.6 | 20.4 | –6.7 |
| Nonwhites | 24,538 | 77.8 | 20,186 | 58.9 | 21,625 | 55.3 | –17.7 | 7.1 | –11.9 |
| Women | 19,550 | 62.0 | 18,397 | 53.7 | 18,945 | 48.4 | –5.9 | 3.0 | –3.1 |
| Whites | 19,390 | 61.5 | 19,033 | 55.5 | 19,306 | 49.3 | –1.8 | 1.4 | –0.4 |
| Nonwhites | 20,321 | 64.4 | 16,998 | 49.6 | 18,342 | 46.9 | –16.4 | 7.9 | –9.7 |

**Table 8.2 Patterns of EC per Person among Low-Education Elders, 1975–2000 (Dollar Amounts in 2000 Dollars)**

| | 1975 | | 1993 | | 2000 | | Change in EC per person (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | EC | Percent of population average EC | EC | Percent of population average EC | EC | Percent of population average EC | 1975–1993 | 1993–2000 | 1975–2000 |
| Total working-age population | 31,541 | 100.0 | 34,287 | 100.0 | 39,138 | 100.0 | 8.7 | 14.1 | 24.1 |
| High schooi dropouts | | | | | | | | | |
| Men | 32,650 | 103.5 | 29,262 | 85.3 | 27,692 | 70.8 | –10.4 | –5.4 | –15.2 |
| Whites | 33,997 | 107.8 | 30,963 | 90.3 | 30,826 | 78.8 | –8.9 | –0.4 | –9.3 |
| Nonwhites | 26,838 | 85.1 | 25,712 | 75.0 | 23,600 | 60.3 | –4.2 | –8.2 | –12.1 |
| Women | 18,125 | 57.5 | 18,654 | 54.4 | 20,234 | 51.7 | 2.9 | 8.5 | 11.6 |
| Whites | 18,421 | 58.4 | 19,468 | 56.8 | 21,551 | 55.1 | 5.7 | 10.7 | 17.0 |
| Nonwhites | 17,035 | 54.0 | 17,325 | 50.5 | 18,774 | 48.0 | 1.7 | 8.4 | 10.2 |
| High school graduates | | | | | | | | | |
| Men | 43,529 | 138.0 | 40,394 | 117.8 | 43,308 | 110.7 | –7.2 | 7.2 | –0.5 |
| Whites | 44,020 | 139.6 | 41,640 | 121.4 | 45,318 | 115.8 | –5.4 | 8.8 | 2.9 |
| Nonwhites | 36,599 | 116.0 | 32,605 | 95.1 | 35,028 | 89.5 | –10.9 | 7.4 | –4.3 |
| Women | 23,658 | 75.0 | 25,108 | 73.2 | 26,695 | 68.2 | 6.1 | 6.3 | 12.8 |
| Whites | 23,692 | 75.1 | 25,315 | 73.8 | 26,973 | 68.9 | 6.9 | 6.5 | 13.8 |
| Nonwhites | 23,045 | 73.1 | 23,951 | 69.9 | 25,434 | 65.0 | 3.9 | 6.2 | 10.4 |

**Table 8.3 Patterns of EC Utilization among Low-Education Youths, 1975–2000**

| | 1975 | | 1993 | | 2000 | | Change in CUR (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | CUR | Percent of population average CUR | CUR | Percent of population average CUR | CUR | Percent of population average CUR | 1975–1993 | 1993–2000 | 1975–2000 |
| Total working-age population | 62 | 100.0 | 65 | 100.0 | 72 | 100.0 | 5.3 | 11.1 | 17.0 |
| High school dropouts | | | | | | | | | |
| Men | 50 | 80.2 | 48 | 72.9 | 51 | 70.2 | –4.3 | 6.9 | 2.3 |
| Whites | 51 | 82.7 | 45 | 69.3 | 46 | 63.4 | –11.8 | 1.7 | –10.3 |
| Nonwhites | 46 | 74.1 | 51 | 78.0 | 56 | 77.6 | 10.9 | 10.5 | 22.6 |
| Women | 20 | 31.6 | 23 | 35.5 | 36 | 49.7 | 18.5 | 55.6 | 84.4 |
| Whites | 21 | 34.2 | 25 | 38.0 | 41 | 56.2 | 17.1 | 64.3 | 92.4 |
| Nonwhites | 17 | 26.7 | 21 | 32.4 | 33 | 45.0 | 27.7 | 54.3 | 97.0 |
| Single women with children | 18 | 28.8 | 19 | 28.8 | 37 | 50.5 | 5.1 | 95.3 | 105.3 |
| Whites | 23 | 36.5 | 22 | 33.1 | 38 | 51.9 | –4.4 | 74.1 | 66.3 |
| Nonwhites | 13 | 20.9 | 16 | 24.7 | 36 | 49.5 | 24.7 | 122.4 | 177.2 |
| High school graduates | | | | | | | | | |
| Men | 67 | 108.2 | 64 | 98.7 | 67 | 92.4 | –4.0 | 4.1 | 0.0 |
| Whites | 68 | 109.1 | 67 | 103.2 | 69 | 95.2 | –0.4 | 2.6 | 2.1 |
| Nonwhites | 64 | 102.6 | 58 | 88.3 | 62 | 85.9 | –9.5 | 8.2 | –2.0 |
| Women | 49 | 78.6 | 49 | 74.6 | 54 | 74.4 | –0.1 | 10.9 | 10.8 |
| Whites | 51 | 82.6 | 52 | 80.4 | 57 | 78.8 | 2.4 | 8.9 | 11.5 |
| Nonwhites | 37 | 59.9 | 39 | 60.3 | 48 | 66.7 | 5.9 | 23.0 | 30.3 |

**Table 8.4 Patterns of EC Utilization among Low-Education Elders, 1975–2000**

| | 1975 | | 1993 | | 2000 | | Change in CUR (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | CUR | Percent of population average CUR | CUR | Percent of population average CUR | CUR | Percent of population average CUR | 1975–1993 | 1993–2000 | 1975–2000 |
| Total working-age population | 62 | 100.0 | 65 | 100.0 | 72 | 100.0 | 5.3 | 11.1 | 17.0 |
| High school dropouts | | | | | | | | | |
| Men | 54 | 87.7 | 41 | 63.5 | 51 | 70.7 | –23.9 | 23.8 | –5.8 |
| Whites | 54 | 87.7 | 40 | 61.8 | 46 | 63.5 | –25.8 | 14.2 | –15.3 |
| Nonwhites | 55 | 88.3 | 44 | 67.7 | 60 | 82.9 | –19.3 | 36.2 | 9.9 |
| Women | 26 | 41.9 | 25 | 39.1 | 25 | 33.9 | –1.8 | –3.4 | –5.2 |
| Whites | 26 | 42.7 | 26 | 40.1 | 24 | 33.4 | –1.1 | –7.5 | –8.5 |
| Nonwhites | 24 | 38.6 | 24 | 37.1 | 25 | 34.6 | 1.1 | 3.8 | 4.9 |
| High school graduates | | | | | | | | | |
| Men | 64 | 104.0 | 47 | 72.0 | 55 | 75.7 | –27.1 | 16.9 | –14.8 |
| Whites | 65 | 105.0 | 47 | 71.7 | 55 | 76.6 | –28.1 | 18.7 | –14.7 |
| Nonwhites | 53 | 85.9 | 49 | 74.5 | 52 | 71.1 | –8.7 | 6.1 | –3.1 |
| Women | 34 | 54.7 | 36 | 55.7 | 39 | 53.9 | 7.3 | 7.5 | 15.3 |
| Whites | 34 | 54.3 | 36 | 55.6 | 39 | 54.5 | 7.9 | 8.9 | 17.5 |
| Nonwhites | 39 | 62.4 | 37 | 56.4 | 37 | 50.9 | –4.8 | 0.2 | –4.6 |

# 9
# Measuring Levels, Trends, and Utilization of Human Capital

## Conclusions and Policy Insights

### EARNINGS CAPACITY AS A HUMAN CAPITAL INDICATOR

In this monograph, we have defined an indicator of the level of human capital in an economy, Earnings Capacity (EC). We have documented the procedure for estimating this measure and shown that both the aggregate indicator and a variety of subgroup indicators can be readily and promptly measured on an annual basis, using publicly released information from the annual March CPS available from the Census Bureau. Our procedure provides an ongoing statistical series describing the level of human resource inputs that are available for productive market activities in the economy. It also serves as the basis for measuring the extent to which the nation's human capital is utilized.

This indicator is a marked improvement over existing statistical measures of human capital and its utilization. The potential contribution of workers and their skills—*human capital*—to the economy depends on both the number of people that are available to work and the skills (or productivity) of these workers. Yet, existing statistical series describing the nation's human capital measure only the first of these elements; they simply count the number of people in the labor force or the number of people employed. These statistical series, therefore, convey little regarding the value of these individuals to the nation's productive capability. Moreover, in assessing the utilization of the human capital stock, existing measures also rely on simple counts. Examples of such indicators are the number of workers employed divided by the number of workers in the labor force (the employment rate) or the number of workers who are not working but who are seek-

ing work divided by the number of workers in the labor force (the unemployment rate).

These standard statistical measures of human capital and its utilization, in essence, treat all people and their human capital as being identical, as having the same potential to contribute to the nation's output.

In contrast to these count-type human capital measures, the standard statistical series measuring the level and utilization of the nation's physical capital stock are expressed in dollar values. This practice recognizes that not all machines have the same age and capability of contributing to the nation's production and that not all factories represent the same amount of physical capital. In essence, each machine and factory is valued by its potential contribution to the nation's output.

Instead of being a simple count, our EC indicator is a dollar-valued measure. As such, it is similar in concept to the nation's statistical series portraying the level of physical capital and its utilization. Earnings Capacity begins with counts of people of working age, as in the existing statistical series, but then measures in dollar terms the productivity of the potential services that each person can contribute to market production. The EC indicator then weights each person by this dollar-valued measure of the potential productivity that they are capable of contributing to the national output.

Thought of in this way, EC is the market value of the full potential contribution to annual national output that the working-age population is able to generate. In practical terms, EC is equal to the annual gross earnings that would be generated in the United States if all people of working age were to employ their skills, knowledge, and labor services in FTFY market work. In somewhat more technical terms, EC is the annual potential rental value of the services of the human capital stock held by the nation's working-age citizens.

## PRESUMPTIONS UNDERLYING THE EC INDICATOR

To be sure, our EC indicator of human capital and its utilization falls short of measuring the full value of the nation's human capital stock and its use. It is an annual indicator based on flows of potential

services and not a measure of the stock of human capital, which must reflect the present value of the full lifetime flow of potential services.

Other researchers have also attempted to measure this human capital stock, as we discussed in Chapter 4. While our EC indicator rests on a variety of assumptions that we have noted, estimated measures of the value of the human capital stock also rest on numerous heroic assumptions. Moreover, proposed and existing measures of the value of the stock of human capital have far greater data requirements than our EC indicators and, hence, cannot be computed and reported in a timely way, restricting their practical use. Moreover, measures of the full human capital stock cannot easily be used as the basis for assessing the utilization of human capital, as can our EC indicator.

Given the special nature of the EC measure as a human capital indicator, the assumptions on which it rests should again be recalled, as several of them are controversial. Perhaps the presumption of most concern to some is our use of prices taken from the labor market to assign values to human capital services. Our use of market wage rates and market earnings to reflect the social value of the services of people surely ignores a variety of valuable spillovers associated with human activities, some of which are positive and some negative. While we acknowledge this shortfall of the EC indicator from some ideal social measure of the value of human activities, we note that market wages and earnings as measures of economic productivity do have a sound basis in economic theory. Indeed, such market-based values are the bedrock on which nearly all statistical series designed to reveal the nation's economic performance are based.

A related concern with the prices revealed in the labor market, and hence our procedure, is the fact that market wages and earnings reflect society's implicit valuation of the services brought to the market by people with different characteristics. For example, labor services provided by racial minorities or women with a certain level of skills and training earn a wage rate below that of members of majority racial groups or males with these same characteristics. The basis of these differences is poorly understood, but it may reflect patterns of racial and gender discrimination that pervade the buying and selling of labor services. By accepting these market values, we are implicitly accepting the market process that yields them. While this may not be comfortable, it is no different than the acceptance of wages and earnings by the

nation's statisticians in providing measures of national income or personal income, both basic and standard national statistical series. Moreover, we would emphasize that the procedure that we have adopted could be easily adapted to suppress whatever racial or gender differences in wages and earnings that users of the measures would choose to neglect. Indeed, this procedure could be adapted to assign the identical wage to each working-age person and calculate the level and trend of both the EC indicator and measures of the utilization of human capital on this basis. Assigning an identical wage to each person, we would note, approximates the count-based human capital statistical series that are commonly used.

Our definition of the "potential" level of productive activities (2,000 hours per year, equivalent to FTFY work) is also controversial. Some note that a wide variety of people's productive activities involve efforts that extend well beyond eight-hour days, five-day work weeks, and 50-week work years. Perhaps the most noteworthy are the hours of productive time by the caregivers of children, the sick, or the elderly, which extend well beyond this FTFY norm. We chose the FTFY norm for a solid reason, however. Our objective is to provide indicators of the value of human capital and its use in market activities that are analogous to the standard statistical measures of physical capital and its utilization, and indeed to the most fundamental measures of economic performance, such as the Gross National Product. Our EC-based measures do no better in reflecting extended values of productive activities such as home production or volunteer activities or spillover gains and losses than these existing measures, but they do no worse. Moreover, if we attempted to value these additional productive activities and include them in our measures, we would encounter all of the difficulties and criticisms that have been leveled at other research studies that have attempted to value these services.

## OBJECTIVES AND USES OF THE EC INDICATOR

### Monitoring Social and Economic Trends

The EC human capital indicator can be readily used to monitor a wide variety of important social and economic trends, primarily those related to the value of the potential human capital services of subgroups of the population and the utilization of human capital by these groups. For example, trends in the EC of whites and nonwhites, of men and women, of young workers and older workers, and of those with high and low levels of schooling can all be estimated and tracked. Similarly, trends in the extent to which these groups utilize their human capital are readily calculated. These trends shed light on a number of questions important to analysts, researchers, and policymakers interested in long-term developments in the economy and the labor market.

In previous chapters, we calculated a large number of these trends over the period from 1975 to 2000, and we have displayed them in numerous tables and figures. Many of these trends provide insights into various labor market and human capital utilization questions often raised in research studies and policy discussions. The following questions illustrate some of these issues.

- Among older workers, has the prominent 1970s and 1980s trend toward lower capacity utilization (due, for example, to early retirement) continued into the 1990s?
- Has the value of the potential human capital services of young nonwhite males, and the utilization of these potential services, increased over time or have these values stagnated or even deteriorated? How do the long-term trends in both EC and the utilization of this capacity of minority youths compare with those of young white males or of older groups?
- Is the rise in women's earnings relative to those of men due to increases in their human capital or is it due to the increased utilization of their human capital in market activities? Have these gains, so prominent in the 1970s and 1980s, persisted into the 1990s?
- Is the increase in income inequality, reflected in an increasing

gap between those with education and those with few skills, been fueled by increases in the relative human capital (EC) of the highly educated or have skilled workers simply increased the utilization of their human capital by more than those with little education?

**Providing Policy Relevant Information**

In addition to revealing these long-term demographic and labor-market patterns, estimates of the level of EC and its utilization also provide insights that are directly related to public policy concerns. One of the most prominent national social policy issues—concern with the costs and consequences of welfare programs—resulted in the national welfare reform legislation of 1996. This reform was directly targeted at unmarried mothers with low education, found primarily on the welfare rolls and not in the workforce. The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA) sought to carry out the pledge of both Congress and the President to substitute work for welfare for these women. Increases in the generosity of work-related subsidies, such as the Earned Income Tax Credit (EITC), were designed to assist in this effort. Were these measures successful? Have low-skilled single mothers increased the utilization of their human capital in market work since the reform legislation was passed and, if so, to what extent?

One of the issues surrounding the welfare-to-work strategy is the potential for policymakers to focus on a goal of immediate employment to the relative neglect of training and skill development. Many doubted that the reform could be successful if these women with little work experience and sparse human capital were simply thrown onto the job market unprepared. Since the implementation of the 1996 reforms, what has happened to the value of the human capital—the EC—of these mothers? Has it increased, decreased, or remained stagnant? What are the policy implications of these patterns?

The extremely low employment levels of nonwhite youths (primarily, males) has persisted for decades and has long been regarded as a major failing of U.S. labor-market policy. In spite of numerous training programs and billions of dollars of expenditures, nonwhite youths seem to choose activities other than formal market work and employ-

ment far more often than other socioeconomic groups, with serious long-term social consequences. What, in fact, has been the long-term trend in the value of the human capital held by these youths? Has it been increasing, perhaps reflecting the effects of numerous job-training and skill-development programs, or has it not? Have nonwhite youths experienced long-term decreases in work, earnings, and other aspects of labor-market performance, as some have claimed, or have they increased the utilization of their human capital in market activities? Has the period of rapid growth during the 1990s led to increases in the market opportunities and, hence the human capital, of these youths—or has it not? Have they increased the utilization of their human capital during this period or not?

The exit from market work of older people of working age, primarily males, is also of concern to economists and policymakers. The loss of skills, experience, and productivity to the nation's production process that is implied by this exit is seen as inhibiting economic growth and macroeconomic performance. Many see this exodus as reflecting the rational choices of older workers who can either continue to work and receive wages or retire on public and private pension income. Viewed in this context, the accessibility and generosity implicit in the structure of both public disability and retirement programs is seen as encouraging early retirement. Reducing benefits, increasing minimum retirement ages, and raising the bar for gaining access to disability benefits have often been proposed to reduce early exit from the labor market. However, prior to undertaking such measures, policymakers need to fully understand the extent of the exit from market work that has occurred and whether this pattern is attributable to the incentives in these public programs. What has been the extent of the decrease in human capital utilization among older workers? Is it concentrated among those with low levels of skills and education or have workers with relatively high levels of human capital also left market work? Has the decrease in utilization continued into the 1990s or has it ceased or even turned around? Does the reduction in utilization parallel the changes over time in the market opportunities of older workers—their EC—or does it not?

### Estimating Costs of Unrealized Potential Earnings

Beyond revealing levels and trends in EC and its utilization, our estimates have also provided important dollar-valued measures of the costs associated with a variety of circumstances and choices that have led to less than full-potential market use of human capital. What are the annual losses—costs—of illness and disability in terms of unrealized potential market production? Have these costs been increasing or decreasing over time? Within which population groups are these costs concentrated? What is the cost to the nation, in terms of unrealized market output, of shortfalls in macroeconomic performance resulting in levels of market work below full employment or potential levels? Much of the gap between EC and actual market earnings is due to voluntary individual choices to engage in home production or volunteer activities; what is the cost to the nation of the unrealized market output which is attributable to these choices? Has the value of lost market productivity due to home production or volunteer activities been rising or not?

Answers to questions such as these are basic to understanding how the nation's labor market and economy are working and for identifying stresses and adverse developments that undermine its performance. Efforts to develop policy measures designed to correct imbalances or to improve performance require information on the level and trend in the nation's human capital and the utilization of these assets. They are also aided by evidence on the costs associated with various reasons for the diversion of human capital from market work activities, as well as the trends in these costs.

## A REVIEW OF FINDINGS ON HUMAN CAPITAL LEVELS AND UTILIZATION

In Chapters 6 to 8, we have provided a broad-brush picture of a number of these levels, patterns, and trends. Here, we simply highlight some of the most important of these findings and note that many additional insights are embedded in the figures in the volume. In addition, still other patterns and trends, answering other important and interest-

ing questions, can be readily obtained from the calculations that underlie the figures and tables presented in this volume.

**Aggregate and Per Person EC Levels and Trends**

- The annual rental value of the nation's human capital stock—aggregate EC—stands at $6.26 trillion in the year 2000, an increase of nearly 75 percent since 1975.
- The actual earnings of the working-age population were $4.5 trillion in 2000, or about 72 percent of this capacity or potential value. The ratio of actual earnings to EC was only about 62 percent in 1975. By way of comparison, the nation's potential GDP was $9.7 trillion in 2000, more than double its level of $4.6 trillion in 1975. The nation's net *stock* of private fixed assets was about $10.7 trillion in 2000, again more than double its value in 1975.
- Per capita EC was about $39,100 in 2000, an increase of nearly 25 percent since 1975. The level was $46,500 for men and $32,100 for women.
- While per capita male EC grew by only 16 percent since 1975, for women it grew by 36 percent, substantially narrowing the gap. The highest rates of EC growth were experienced by whites, older working age people, and those with a college education. The growth in EC for males, nonwhites, those with less schooling, and youths was substantially below the average for all working-age people.

**The Utilization of Human Capital**

In 2000, the utilization rate for the nation's human capital was 72 percent, capping an erratic but persistent increase from the 62 percent recorded in 1975. Men realized about 81 percent of their EC in 2000, while women realized about 61 percent. However, the utilization rate for women increased by 50 percent (from 41 percent since 1975) while that for men edged up only slightly. The rate of capacity utilization is particularly low for older workers (58 percent) and those with less than a high school degree (49 percent).

## Unrealized Potential Earnings and Its Sources

Unrealized potential earnings (the gap between EC and earnings) per working-age man was about $6,600 in 2000 and showed very little change since 1975. On the other hand, average unrealized potential earnings for women was over $10,500 in 2000, but it had fallen by over $2,000 since 1975. For the entire working-age population, unrealized potential earnings averaged $8,600 in 2000, down from $9,800 in 1975, primarily because of the increase in women's time allocated to market work.

There are several reasons that people give for not utilizing their human capital to its full potential in market work, including the following.

- Home production: about 32 percent of the total amount of unrealized potential earnings, down from over 50 percent in 1975.
- Unemployment: about 11 percent of the total in 2000, down from about 25 percent during the recessions of the early 1980s and early 1990s.
- Illness/disability: 21 percent of the total in 2000, up from 14–16 percent during the 1970s and 1980s.
- Retirement prior to age 65: 16 percent of total unrealized potential earnings in 2000, up from about 4 percent in 1975.
- Voluntary choice of part-time, rather than full-time, work: 10 percent of the total in 2000, up from 6 percent in 1975.

## The Costs of Unrealized Potential Earnings

Stated in dollar terms, these components of unrealized potential earnings reflect costs to the nation in the form of unrealized market output. In both aggregate and per person terms, they are as follows.

- Home production: $435 billion in unrealized potential earnings in 2000, down from $562 billion in 1975 (about $2,700 per person in 2000, down from $4,900 per person in 1975).
- Unemployment: $150 billion in unrealized potential earnings in 2000, down from over $300 billion in the recessions of the early 1980s and early 1990s ($1,000 per person in 2000, compared

with a loss of $2,700 per person in the early 1980s).

- Illness/disability: $300 billion in unrealized potential earnings in 2000, up from about $160 billion in 1975 (nearly $1,850 per person in 2000, up from about $1,350 per person in 1975).
- Retirement prior to age 65: $230 billion in unrealized potential earnings in 2000, up from about $50 billion in 1975 ($1,400 per person in 2000, up from $425 per person in 1975).
- Voluntary choice of part-time, rather than full-time, work: $140 billion in unrealized potential earnings in 2000, up from $65 billion in 1975 ($850 per person in 2000, up from $570 per person in 1975).

## Per Capita EC and EC Utilization among Racial, Schooling, and Age Groups

We have also used the EC indicator to study the levels and trends in potential human capital services of racial, schooling, and age groups. Human capital utilization patterns among these groups have also been analyzed. Several patterns stand out.

### Racial patterns

- By 2000, whites averaged $42,700 in EC, an increase of 31 percent since 1975. Nonwhites had attained an average EC of $30,400 by 2000, an increase of only 18 percent. The racial human capital gap increased over the period, including the most recent period of economic growth.
- In 1975, whites were utilizing 63 percent of their EC, while nonwhites were utilizing 57 percent. By 2000, white utilization had increased to 73 percent, while nonwhites had increased their utilization to 71 percent. By 2000, the racial gap in utilization was thus virtually closed.

### Schooling patterns

- In 2000, the EC gap between working-age people with less than a high school degree (at $23,000) and those with a college degree (at $59,500) stood at $36,500, an increase of 75 percent from the $21,000 gap that existed in 1975. This implies a radical

increase in the human capital returns on schooling over the period.

- Given the growing disparity in potential rewards for labor-market work, the widening gap between the market utilization of those with more than a high school degree and those with no degree is not surprising. The human capital utilization of the first group increased by about 10 percent from 1975 to 2000, while the second experienced virtually no increase in utilization. Only a surge in utilization by the low-schooling group during the 1990s prevented a substantial *reduction* in its utilization rate over the period.

### Age patterns

- By 2000, people aged 40–54 averaged $45,000 of EC, while the average for those 18–24 was about $23,000, a ratio of nearly two to one. Over the period from 1975 to 2000, the EC gap between the two groups increased from $12,000 to nearly $22,000. Disparities in human capital among age groups also increased substantially over the period.
- With these increased gaps in EC, the 18 percent increase in the utilization rate of workers aged 40–54 relative to the 11 percent increase for workers aged 18–24 could be expected.

## Earnings Capacity and Its Utilization among Vulnerable Population Groups

Finally, we have studied the levels and trends in EC and its utilization for a number of groups among the working-age population that are of particular concern—low-education youths, low-education single mothers, and low-education older workers. Again, the results are revealing.

### Low education youths

- In 2000, the EC of young nonwhite male dropouts stood at a very low level of $18,000, a decrease of nearly 17 percent since 1975. Young nonwhite female dropouts had potential earnings of about $15,000 in 2000, a fall of nearly 16 percent since 1975.

- In spite of these low and declining levels of EC, nonwhite youths increased the utilization of their human capital—over 22 percent for males (to 56 percent by 2000) and nearly 100 percent for females (to a still very low level of 33 percent by 2000).

**Low-education single mothers**

- The EC of single mothers without a high school degree—the group largely targeted by the welfare-to-work reform of the mid 1990s—was less than $13,000 in 1995, having fallen from about $18,000 in 1975. However, in part because of the prosperity of the late 1990s, the EC of these low education young mothers had risen to about $15,000 by 2000.
- It is with respect to the utilization of their low human capital that a virtual revolution has occurred. For these low-education mothers, human capital utilization was less than 20 percent from 1975 to the eve of welfare reform. However, in the subsequent years, the utilization rates soared, stimulated by both the economy and the major emphasis on work that pervaded welfare policy during this period. By 2000, the capacity utilization rate of young, low-education, single females with children had risen to nearly 37 percent, over twice their levels earlier in the decade.

**Low-education older workers**

- Over the 1975–2000 period, the average EC of older men—those aged 55–64—with less than a high school degree dropped about $5,000 to $27,700. A similar, but less severe, eroding pattern exists for older men with a high school degree. For older low-education women, however, the EC trend was quite different, with an increase of about 12 percent recorded over the same period.
- From 1975 to the early-1990s, the rate of capacity utilization for older men with a high school degree or less fell persistently—an overall decrease of about 25 percent (from 64 percent to 47 percent for those with a high school degree, and 54 to 41 percent for dropouts). However, since that time the utilization rate of male graduates increased by 17 percent (to 55 percent) while that of male dropouts soared by 24 percent (to 51 percent). Con-

sistent with the research findings of others, the trend toward early exit from the workforce for older workers appears to have been reversed, at least temporarily.

## SOME POLICY INSIGHTS

In addition to revealing interesting and important social and labor-market developments, our EC and utilization estimates can offer important insights regarding a number of policy relevant developments in the labor market. In most cases, these are seen in the analyses done for smaller subgroups of the working-age population.

### Welfare Reform and the Market Use of Human Capital by Low-Education Single Mothers

Perhaps the most vivid insight is the remarkable upswing in human capital utilization of low-education single mothers with children, the target of the welfare reform legislation of the mid 1990s. Utilization rates for both white and nonwhite single mothers were notoriously low in the years preceding the end of the recession of the early 1990s—slightly above 20 percent for whites and slightly below for nonwhites. Beginning in 1993, when the economy began to recover and welfare-to-work legislation began to be seriously debated, the utilization rates for both racial groups soared, with both groups attaining utilization rates of nearly 40 percent by 2000. The question, of course, is to what is this increase in human capital utilization attributable—the economy or welfare reform policy?

The long record of utilization rates for this group is able to shed some light on this question. In fact, the remarkable increase in utilization rates for this group of welfare eligible mothers is unprecedented over the period for which we have tracked this variable. During other periods of growth after 1975 and until the early 1990s, e.g., the period from 1984 to 1990, there is no visible upward movement in utilization rates for these single mothers. We conclude that the bulk of this increase in labor-market activities is to be laid at the doorstep of welfare reform policy, rather than economic growth. Of course, this says

little about what aspects of the policy—the culture which surrounded the debate over welfare reform, the early "waiver experiments" that states undertook prior to the federal legislation, the simultaneous increase in work-related benefits such as the EITC, or actual state efforts to promote work and divert people from benefit receipt—may have brought about this result. Nevertheless, the evidence here suggests that the combination of the reform debate and legislation did have the desired effect of increasing the efforts to find market work by these women—efforts that were supported by the economy.

### Policy Incentives, the Economy, and the Use of Human Capital by Older, Low-Skilled Men

A second insight relates to the concern of policymakers regarding the exit from market work of older men, primarily those with relatively poor labor-market prospects. Earlier research had alerted policymakers to the budget costs and economic consequences of the decision to seek disability and early retirement social insurance benefits by older males. Our estimates also reveal this pattern. For both older male high school dropouts and graduates, utilization rates fell by at least 10 percentage points from 1975 to 1991. However, after the end of the recession of the early 1990s, utilization rates rose for both groups—by about eight percentage points for graduates and about 10 for dropouts. By 2000, the human capital utilization rate for dropouts stood at nearly the same level as in 1975.

As in the case of low-education single mothers, the policy issues here concern the reasons for the turnaround in utilization rates during the 1990s and its permanence. Recent research, using count-data—labor force participation rates—has also discerned this reversal in early retirement patterns, and one prominent study has dated the change in early retirement choices at some point in the mid to late 1980s (see Quinn 2000). Our estimates (see Figure 8.12) indicate continued erosion in human capital utilization until the early 1990s, with the distinct turnaround coming after the recession at that time.

Quinn (2000) attributed the bulk of the turnaround to a series of policy changes, nearly all of which provided increased incentives for continued market work for older people—the elimination of mandatory retirement in the late 1980s, a series of policy changes in the Social

Security retirement program that increased the rewards for continued work, and the shift from defined benefit to defined contribution retirement plans (which was in part encouraged by policy measures). Costa (1998, 2000), on the other hand, saw the cessation of the pattern of increasing early retirement in the 1990s as simply a pause, induced by the robust labor demands accompanying the prosperity of that period. As in the case of the low-education single mothers, the shift in behavior patterns over the past decade is unique. None of the other periods of expansion and growth since 1975 seemed able to retard what seemed like an inexorable trend toward early retirement and the reliance on public and private pension benefits for income support.

## The Utilization of Human Capital by Nonwhite, Low-Skilled Youths and the Potential Effectiveness of Targeted Employment Programs

Numerous studies have documented the low employment rate of low-education, young, nonwhite men. While most recent studies indicate increased labor market success for this disadvantaged group during the 1990s, Holzer and Offner (2002) have taken issue with this conclusion. Using count-type indicators of labor market activity—the employment–population ratio and the labor force participation rate—they concluded that both of these indicators point to continuing declines in the labor-market activity of young minority males with low levels of schooling. For example, from 1989 to 1999/2000, they found the employment–population ratio for black youths aged 16–24 with a high school degree or less to have fallen from 59 percent to 52 percent, with greater decreases recorded for dropouts than for high school graduates. They attributed this continued decrease to some combination of a decreasing true skill level for those youths who are not in school, a decline in the demand for low-skill workers, and (perhaps) the increasingly rigorous enforcement of court-imposed child support orders (which imply substantial reductions in net wages available from working). If correct, these results might be discouraging to those who advocate continuation or expansion of training and work-oriented programs directed at this population. There is clearly little evidence that they have produced gains in labor-market performance, even during the robust economy of the decade of the 1990s.[1]

Our results, on the other hand, differ substantially from the Holzer and Offner findings. Over the entire period from 1975 to 2000, the utilization rate—reflecting both the extent of labor-market activity and its market value—for nonwhite male high school dropouts aged 18–24 increased from 46 percent to 56 percent, with about half of the increase coming prior to 1993. Young, nonwhite male graduates recorded a slight decrease in human capital utilization over the entire period, from 64 percent to 62 percent. However, the utilization rate for this group rose by over 8 percent, from 58 percent to 62 percent from 1993 to 2000. For the entire group of low-education nonwhite youths, increases in capacity utilization recorded both over the entire period, and during the 1990s, outstripped the very modest gains for white low-education youths. This picture, of course, squares more closely with utilization patterns for other low-skill groups over this period, especially in the 1990s. The capacity utilization findings cast a far more favorable light on the potential efficacy of labor-market training and employment programs focused on this group of hard to employ potential workers.

## Note

1. This inference is ours and not that of Holzer and Offner.

# Appendix A

## The Estimation of EC

As described in the text, EC is a measure of individuals' potential earnings, defined as the earnings they would receive if they worked at FTFYcapacity in a job consistent with their human capital characteristics. Estimation of EC is a multistep process which relies on the observed earnings and characteristics of FTFY workers to predict FTFY earnings for all working-age individuals, including those who work less than FTFY and those who do not work at all. We then make a series of adjustments to these predictions to arrive at an estimate of EC for each individual.

We begin by drawing repeated cross sections of the U.S. population from the March CPS for 1976–2001. For each year, we select a subsample of 18–64-year-old, noninstitutionalized, nonstudent, non-self-employed civilians. From this population of working-age adults, we identify those who work FTFY, defined as having 2,000 or more hours of work in a year, with wage and salary earnings of at least $2,000.[1] Following Heckman (1979), these data are used to estimate a two-stage model of FTFY work and earnings. Such a specification is appropriate, since individuals can select into the FTFY labor force.

The first stage is a probit regression of FTFY work on a vector of explanatory variables assumed to influence such participation. The dependent variable is a binary variable indicating whether the individual is a FTFY worker or not. We fit four such probits for each year, one for each race–gender group (whites/nonwhites, males/females). The coefficient estimates are used to calculate the inverse Mills ratio for each worker. These ratios are used in the second stage, described below. The coefficient estimates, standard errors, sample sizes, and log-likelihoods for each probit are available from the authors upon request.

The second stage is a set of selectivity corrected ordinary least squares regressions of the natural logarithm of earnings on those variables assumed to influence such earnings. These regressions are estimated over the subset of workers defined to be working FTFY. As noted in the text, we correct for selection into the FTFY labor force by appending the inverse Mills ratio as an additional regressor for each worker. The regression results, with corrected standard errors, for the four race–gender groups in the 26 years of our study, along with sample sizes, *R*-squared statistics, and the corrected standard error of the regression, are available from the authors upon request.

Table A.1 lists the variables used in the model, provides descriptions of each, and indicates which variables form the *exclusion restrictions*, employed to identify the model. The variables used for identification are taken to affect the FTFY work outcome but not the earnings of the individual. That is, conditional on FTFY work, the exclusion restrictions do not affect earnings. These variables include nonlabor income, participation in a disability-related income support program, the state unemployment rate, veteran status (for men), and the maximum Aid to Families with Dependent Children (AFDC) benefit for a family of four (for women).[2] These variables are included in the probit estimations but not in the earnings regressions.

Using the second-stage coefficient estimates and each individual's characteristics, we predict FTFY log earnings for each prime-aged adult in our sample. Note that since we desire estimates of EC for each individual, *unconditional* on selection into FTFY work, we make unconditional predictions of EC. That is, in making our predictions, we set each individual's inverse Mills ratio equal to the mean inverse Mills ratio for workers. This ensures that the mean of the predicted log earnings distribution (among FTFY workers) equals the mean of the actual log earnings distribution (among FTFY workers), while assigning the same predicted log earnings value to individuals with identical characteristics, regardless of their selection into or out of the FTFY labor force.

At this point, we have a prediction of FTFY log earnings for each individual in our sample. However, these values do not account for certain additional factors that may influence EC: unobserved human capital and labor demand characteristics, and "luck" in the earnings determination process. To adjust for these factors, we apply a random shock to each individual's EC prediction. Specifically, we add to each FTFY log earnings prediction the standard error from the individual's race–gender earnings equation times a normal (0,1) random variable. In making this adjustment, we assume that the distribution of FTFY earnings within a race–gender cell is normal with a standard deviation equal to the standard error of the race–gender earnings regression.

The next step is to exponentiate each individual's predicted FTFY log earnings to obtain a prediction of FTFY earnings.[3] A fortunate effect of the random shock administered to the predicted FTFY log earnings values is to inflate the variance of the predicted FTFY earnings distribution (taken over FTFY workers) to match the variance of the actual FTFY worker earnings distribution. This is an important result, and it is necessary for accurately measuring the percentage of individuals or families in any part of the predicted earnings distribution.

To summarize, the predicted value of an individual's earnings capacity can be described as:

$$EC_i = \exp(X_i b + c\lambda_i + \sigma m_i).$$

This is simply Equation 2 from Chapter 5, exponentiated to produce the estimated value of EC. As in the text, $X_i$ are the explanatory variables from the second-stage estimation, $b$ is the vector of coefficient estimates, $c$ is the coefficient estimate for the selectivity correction term ($\lambda$), $\sigma$ is the standard error of the regression corresponding to the individual's race–gender group, and $m_i$ is a randomly distributed $N(0,1)$ variable.

## Notes

1. The 2,000 hours minimum is an accepted societal norm for FTFY employment, while the $2,000 minimum was chosen to satisfy the normality requirements of the Heckman procedure (see below). The Heckman procedure requires that the distribution of the unobserved, random component of FTFY earnings (and hence, FTFY earnings itself) be distributed normally with mean zero. Normality tests of our FTFY earnings sample suggested that a $2,000 lower bound produced a distribution closest to normal. When combined with the notion that an individual earning less than $1 per hour is probably quite unlike what we imagine the typical FTFY worker to be, we felt that the aforementioned cut-points, while somewhat arbitrary, were appropriate.
2. Recall that AFDC was eliminated in 1996 under the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA). For 1997 and forward, we used a state-level benefit series based on Temporary Assistance for Needy Families (TANF) benefits and food stamps consistent with the previous years' AFDC data. We thank Geoffrey Wallace of the University of Wisconsin–Madison for providing us with the post-1996 data.
3. Our procedure for transforming predicted values of FTFY earnings from the logarithmic form in which the earnings functions are specified to absolute dollar amounts differs somewhat from that proposed by Kennedy (1984). We conducted sensitivity tests of our predictions of EC against those that would be generated by Kennedy's method (Kennedy predictions) and found the differences to be negligible. We first compared the distributions of our predictions and the Kennedy predictions for FTFY workers by race and sex to the actual earnings of those same workers. The distributions of both predicted values closely matched the distributions of actual earnings. We also compared the aggregate human capital amounts generated by both types of predictions, again by race and sex. We found that the Kennedy predictions were about 1–2 percent higher than our predictions. Further information is available from the authors upon request. We thank Orlando Sotomayor of the University of Puerto Rico at Mayaguez for bringing the Kennedy article to our attention.

**Table A.1 Variable Definitions**

| Variable | Description |
|---|---|
| Age | Age of the individual. |
| Age squared | Age of the individual, squared. |
| Education | Years of schooling completed by the individual. |
| Education squared | Years of schooling completed by the individual, squared. |
| Age × Education | Age of the individual times years of schooling. |
| Northeast, South, West | Region specific dummy variables. North Central is omitted. |
| City, suburb | Metropolitan Statistical Area (SMSA) status dummies. Rural is omitted. |
| Married, spouse present[a] | Dummy variable indicating the presence of a legal spouse in the household. |
| Have children under 18[a] | Dummy variable indicating the presence of unmarried children under the age of 18 in the family. |
| Number of children under 18 | Number of unmarried children under the age of 18 in the family. |
| Have children under 6 | Dummy variable indicating the presence of children under the age of 6 in the family. |
| Number of children under 6 | Number of unmarried children under the age of 6 in the family. |
| Nonlabor income (000s)*[b] | Total family income from sources exogenous to the labor-market decisions of the individual (in thousands of dollars). |
| Health status* | Dummy variable indicating the individual's participation in a health/disability-related income support program. |
| Unemployment rate* | Unemployment rate in the individual's state of residence. |
| Veteran* | Dummy variable indicating veteran status (men only). |
| Maximum welfare benefit* | Maximum welfare benefit for a family of four in the individual's state of residence (women only). |
| Hispanic | Dummy variable indicating Hispanic ethnicity (nonwhites only). |

NOTE: Starred variables indicate exclusion restrictions. These variables are included only in the first-stage FTFY labor force participation equation. All other variables are included in both stages.

[a] For women, *Have Children under 18 and Married, Spouse Present* are interacted, obtaining an expanded set of dummy variables: *Single, No Children; Single, With Children; Married, No Children;* and *Married, With Children.*

[b] Nonlabor income is the family's non-wage income, less total family social security, supplemental security, public assistance, alimony and child support, less individual unemployment compensation, worker's compensation, veteran's payments, and retirement income.

# Appendix B

**Table B.1 Aggregate EC, Total and Various Groups, 1975 and 2000 (Dollar Amounts in Trillions of 2000 Dollars)**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | EC | Percent of population total | EC | Percent of population total | Change in EC (%) |
| Total (working age population) | 3.60 | 100 | 6.26 | 100 | 73.7 |
| By sex | | | | | |
| Men | 2.20 | 61 | 3.65 | 58 | 65.7 |
| Women | 1.40 | 39 | 2.62 | 42 | 86.3 |
| By race | | | | | |
| Whites | 3.12 | 87 | 4.87 | 78 | 56.1 |
| Nonwhites | 0.48 | 13 | 1.39 | 22 | 187.7 |
| By age | | | | | |
| 18–24 | 0.44 | 12 | 0.42 | 7 | –2.7 |
| 25–39 | 1.33 | 37 | 2.14 | 34 | 60.2 |
| 40–54 | 1.22 | 34 | 2.73 | 44 | 123.9 |
| 55–64 | 0.62 | 17 | 0.97 | 16 | 57.9 |
| By years of schooling | | | | | |
| Schooling = <12 years | 0.85 | 24 | 0.45 | 7 | –47.3 |
| Schooling = 12 years | 1.41 | 39 | 1.72 | 28 | 22.0 |
| Schooling = 13–15 years | 0.58 | 16 | 1.63 | 26 | 179.8 |
| Schooling = 16 years or more | 0.76 | 21 | 2.46 | 39 | 224.0 |

**Table B.2 Aggregate EC, Total and Various Groups by Sex, 1975 and 2000 (Dollar Amounts in Trillions of 2000 Dollars)**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | EC | Percent of population total | EC | Percent of population total | Change in EC (%) |
| Total (Working-age population) | 3.60 | 100 | 6.26 | 100 | 73.7 |
| Men | 2.20 | 61 | 3.65 | 58 | 65.7 |
| White | 1.94 | 54 | 2.89 | 46 | 49.2 |
| Nonwhite | 0.26 | 7 | 0.76 | 12 | 187.6 |
| Age 18–24 | 0.24 | 7 | 0.23 | 4 | –5.3 |
| Age 25–39 | 0.81 | 23 | 1.21 | 19 | 48.9 |
| Age 40–54 | 0.77 | 21 | 1.62 | 26 | 111.2 |
| Age 55–64 | 0.38 | 11 | 0.59 | 9 | 54.5 |
| Schooling = <12 years | 0.52 | 14 | 0.26 | 4 | –49.3 |
| Schooling = 12 years | 0.79 | 22 | 1.00 | 16 | 27.3 |
| Schooling = 13 to 15 years | 0.36 | 10 | 0.90 | 14 | 148.9 |
| Schooling = 16 years or more | 0.53 | 15 | 1.48 | 24 | 178.6 |
| Women | 1.40 | 39 | 2.62 | 42 | 86.3 |
| White | 1.18 | 33 | 1.98 | 32 | 67.4 |
| Nonwhite | 0.22 | 6 | 0.64 | 10 | 187.9 |
| Age 18–24 | 0.20 | 5 | 0.20 | 3 | 0.5 |
| Age 25–39 | 0.52 | 14 | 0.92 | 15 | 77.9 |
| Age 40–54 | 0.45 | 13 | 1.11 | 18 | 145.6 |
| Age 55–64 | 0.24 | 7 | 0.38 | 6 | 63.4 |
| Schooling = <12 years | 0.33 | 9 | 0.19 | 3 | –44.1 |
| Schooling = 12 years | 0.62 | 17 | 0.72 | 11 | 15.3 |
| Schooling = 13 to 15 years | 0.22 | 6 | 0.72 | 12 | 231.4 |
| Schooling = 16 years or more | 0.23 | 6 | 0.99 | 16 | 328.1 |

**Table B.3 Aggregate EC, Total and Various Groups, 1975–2000 (Trillions of 2000 Dollars)**

| | | Sex | | Race | | Age | | | | Education | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Total | Men | Women | White | Non-white | 18–24 | 25–39 | 40–54 | 55–64 | Less than HS | HS graduate | Some college | College graduate |
| 1975 | 3.60 | 2.20 | 1.40 | 3.12 | 0.48 | 0.44 | 1.33 | 1.22 | 0.62 | 0.85 | 1.41 | 0.58 | 0.76 |
| 1976 | 3.78 | 2.32 | 1.47 | 3.28 | 0.51 | 0.45 | 1.42 | 1.27 | 0.64 | 0.86 | 1.47 | 0.62 | 0.84 |
| 1977 | 3.88 | 2.37 | 1.51 | 3.35 | 0.53 | 0.46 | 1.48 | 1.26 | 0.67 | 0.84 | 1.51 | 0.67 | 0.86 |
| 1978 | 4.03 | 2.47 | 1.56 | 3.47 | 0.56 | 0.47 | 1.55 | 1.30 | 0.70 | 0.82 | 1.57 | 0.72 | 0.92 |
| 1979 | 4.11 | 2.52 | 1.59 | 3.51 | 0.59 | 0.48 | 1.62 | 1.29 | 0.71 | 0.82 | 1.60 | 0.73 | 0.96 |
| 1980 | 4.17 | 2.53 | 1.64 | 3.55 | 0.62 | 0.49 | 1.69 | 1.27 | 0.72 | 0.78 | 1.64 | 0.75 | 0.99 |
| 1981 | 4.22 | 2.58 | 1.64 | 3.59 | 0.63 | 0.48 | 1.72 | 1.29 | 0.73 | 0.75 | 1.66 | 0.76 | 1.05 |
| 1982 | 4.31 | 2.59 | 1.72 | 3.65 | 0.66 | 0.47 | 1.78 | 1.33 | 0.75 | 0.72 | 1.66 | 0.80 | 1.13 |
| 1983 | 4.38 | 2.62 | 1.76 | 3.70 | 0.68 | 0.45 | 1.83 | 1.36 | 0.75 | 0.69 | 1.68 | 0.81 | 1.21 |
| 1984 | 4.56 | 2.73 | 1.82 | 3.80 | 0.76 | 0.44 | 1.91 | 1.43 | 0.78 | 0.70 | 1.72 | 0.86 | 1.27 |
| 1985 | 4.63 | 2.79 | 1.85 | 3.85 | 0.78 | 0.43 | 1.99 | 1.46 | 0.76 | 0.67 | 1.72 | 0.91 | 1.33 |
| 1986 | 4.82 | 2.88 | 1.94 | 3.99 | 0.82 | 0.41 | 2.07 | 1.57 | 0.77 | 0.66 | 1.78 | 0.95 | 1.43 |
| 1987 | 4.88 | 2.90 | 1.98 | 4.02 | 0.87 | 0.42 | 2.06 | 1.62 | 0.78 | 0.67 | 1.80 | 0.96 | 1.45 |
| 1988 | 4.94 | 2.92 | 2.01 | 4.04 | 0.89 | 0.39 | 2.09 | 1.68 | 0.77 | 0.64 | 1.78 | 0.97 | 1.54 |
| 1989 | 4.97 | 2.92 | 2.04 | 4.06 | 0.91 | 0.38 | 2.09 | 1.74 | 0.76 | 0.61 | 1.76 | 1.02 | 1.58 |
| 1990 | 4.90 | 2.86 | 2.04 | 4.00 | 0.90 | 0.37 | 2.03 | 1.75 | 0.75 | 0.59 | 1.74 | 1.01 | 1.56 |
| 1991 | 4.93 | 2.86 | 2.06 | 3.99 | 0.94 | 0.35 | 2.02 | 1.83 | 0.72 | 0.50 | 1.65 | 1.18 | 1.59 |
| 1992 | 5.02 | 2.90 | 2.12 | 4.06 | 0.97 | 0.36 | 2.02 | 1.89 | 0.75 | 0.48 | 1.64 | 1.25 | 1.65 |
| 1993 | 5.07 | 2.93 | 2.14 | 4.06 | 1.01 | 0.36 | 2.02 | 1.97 | 0.73 | 0.47 | 1.57 | 1.32 | 1.72 |
| 1994 | 5.18 | 2.99 | 2.19 | 4.14 | 1.04 | 0.35 | 2.03 | 2.05 | 0.75 | 0.46 | 1.57 | 1.35 | 1.80 |
| 1995 | 5.36 | 3.16 | 2.21 | 4.27 | 1.10 | 0.35 | 2.05 | 2.18 | 0.79 | 0.48 | 1.58 | 1.37 | 1.94 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1996 | 5.48 | 3.19 | 2.29 | 4.31 | 1.17 | 0.35 | 2.08 | 2.26 | 0.79 | 0.46 | 1.63 | 1.40 | 1.99 |
| 1997 | 5.73 | 3.35 | 2.38 | 4.50 | 1.23 | 0.37 | 2.10 | 2.39 | 0.87 | 0.47 | 1.70 | 1.47 | 2.09 |
| 1998 | 5.95 | 3.44 | 2.51 | 4.67 | 1.28 | 0.39 | 2.12 | 2.50 | 0.93 | 0.46 | 1.72 | 1.51 | 2.25 |
| 1999 | 6.03 | 3.50 | 2.53 | 4.70 | 1.33 | 0.39 | 2.10 | 2.61 | 0.93 | 0.45 | 1.69 | 1.57 | 2.33 |
| 2000 | 6.26 | 3.65 | 2.62 | 4.87 | 1.39 | 0.42 | 2.14 | 2.73 | 0.97 | 0.45 | 1.72 | 1.63 | 2.46 |

**Table B.4 Working-Age Population Trends, Total and Various Groups, Selected Years 1975–2000 (Total Working-Age Population in Millions; Groups as Percent of Total)**

| | | Percent of total | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sex | | Race | | Age | | | | Education | | | |
| Year | Total | Men | Women | White | Non-white | 18–24 | 25–39 | 40–54 | 55–64 | Less than HS | HS graduate | Some college | College graduate |
| 1975 | 114.3 | 48.0 | 52.0 | 83.6 | 16.4 | 16.3 | 36.5 | 30.0 | 17.2 | 29.0 | 41.9 | 14.8 | 14.3 |
| 1980 | 127.1 | 48.3 | 51.7 | 81.6 | 18.4 | 16.3 | 39.9 | 26.8 | 17.0 | 24.1 | 42.6 | 16.8 | 16.5 |
| 1985 | 136.1 | 48.7 | 51.3 | 78.9 | 21.1 | 14.0 | 43.1 | 26.8 | 16.2 | 19.9 | 42.1 | 18.7 | 19.3 |
| 1990 | 143.4 | 49.0 | 51.0 | 76.9 | 23.1 | 12.0 | 42.8 | 30.3 | 14.8 | 17.5 | 41.0 | 20.1 | 21.4 |
| 1995 | 151.1 | 49.3 | 50.7 | 73.7 | 26.3 | 11.2 | 40.7 | 34.2 | 13.9 | 14.1 | 35.5 | 26.9 | 23.5 |
| 2000 | 160.0 | 49.0 | 51.0 | 71.3 | 28.7 | 11.4 | 36.1 | 37.7 | 14.8 | 12.2 | 34.2 | 27.8 | 25.9 |

**Table B.5 Earnings Capacity per Person, Total and Various Groups, 1975–2000 (Dollar Amounts in 2000 Dollars)**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | EC | Percent of population total | EC | Percent of population total | Change in EC (%) |
| Total (Working-age population) | 31,541 | 100 | 39,138 | 100 | 24.1 |
| By sex | | | | | |
| Men | 40,136 | 127 | 46,505 | 119 | 15.9 |
| Women | 23,613 | 75 | 32,058 | 82 | 35.8 |
| By race | | | | | |
| Whites | 32,666 | 104 | 42,662 | 109 | 30.6 |
| Nonwhites | 25,809 | 82 | 30,365 | 78 | 17.7 |
| By age | | | | | |
| 18–24 | 23,451 | 74 | 23,338 | 60 | –0.5 |
| 25–39 | 32,012 | 101 | 36,994 | 95 | 15.6 |
| 40–54 | 35,492 | 113 | 45,206 | 116 | 27.4 |
| 55–64 | 31,296 | 99 | 41,038 | 105 | 31.1 |
| By years of schooling | | | | | |
| Schooling = <12 years | 25,612 | 81 | 23,035 | 59 | –10.1 |
| Schooling = 12 years | 29,531 | 94 | 31,552 | 81 | 6.8 |
| Schooling = 13–15 years | 34,468 | 109 | 36,558 | 93 | 6.1 |
| Schooling = 16 years or more | 46,396 | 147 | 59,468 | 152 | 28.2 |

**Table B.6 Earnings Capacity per Person, Total and Various Groups by Sex, 1975 and 2000 (Dollar Amounts in Thousands of 2000 Dollars)**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | EC | Percent of population total | EC | Percent of population total | Change in EC (%) |
| Total (Working-age population) | 31,541 | 100 | 39,138 | 100 | 24.1 |
| Men | 40,136 | 127 | 46,505 | 119 | 15.9 |
| White | 41,820 | 133 | 51,115 | 131 | 22.2 |
| Nonwhite | 30,951 | 98 | 34,582 | 88 | 11.7 |
| Age 18–24 | 27,246 | 86 | 25,407 | 65 | –6.7 |
| Age 25–39 | 40,344 | 128 | 42,360 | 108 | 5.0 |
| Age 40–54 | 46,204 | 146 | 54,594 | 139 | 18.2 |
| Age 55–64 | 40,985 | 130 | 52,411 | 134 | 27.9 |
| Schooling = <12 years | 32,473 | 103 | 26,586 | 68 | –18.1 |
| Schooling = 12 years | 38,360 | 122 | 37,148 | 95 | –3.2 |
| Schooling = 13–15 years | 42,476 | 135 | 43,667 | 112 | 2.8 |
| Schooling = 16 years or more | 54,408 | 173 | 70,967 | 181 | 30.4 |
| Women | 23,613 | 75 | 32,058 | 82 | 35.8 |
| White | 24,043 | 76 | 34,363 | 88 | 42.9 |
| Nonwhite | 21,548 | 68 | 26,520 | 68 | 23.1 |
| Age 18–24 | 20,078 | 64 | 21,361 | 55 | 6.4 |
| Age 25–39 | 24,177 | 77 | 31,718 | 81 | 31.2 |
| Age 40–54 | 25,463 | 81 | 36,129 | 92 | 41.9 |
| Age 55–64 | 22,640 | 72 | 30,811 | 79 | 36.1 |
| Schooling = <12 years | 19,241 | 61 | 19,364 | 49 | 0.6 |
| Schooling = 12 years | 22,870 | 73 | 26,066 | 67 | 14.0 |
| Schooling = 13–15 years | 26,239 | 83 | 30,380 | 78 | 15.8 |
| Schooling = 16 years or more | 34,676 | 110 | 47,882 | 122 | 38.1 |

**Table B.7 Earnings Capacity per Person, Total and Various Groups, 1975–2000 (2000 Dollars)**

| Year | Total | Men | Women | White | Nonwhite | 18–24 | 25–39 | 40–54 | 55–64 | Less than HS | HS graduate | Some college | College graduate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1975 | 31,541 | 40,136 | 23,613 | 32,666 | 25,809 | 23,451 | 32,012 | 35,492 | 31,296 | 25,612 | 29,531 | 34,468 | 46,396 |
| 1976 | 32,638 | 41,516 | 24,395 | 33,873 | 26,401 | 23,767 | 33,102 | 37,187 | 32,212 | 26,183 | 30,507 | 35,240 | 48,041 |
| 1977 | 32,894 | 41,757 | 24,668 | 34,243 | 26,313 | 24,028 | 33,377 | 37,282 | 32,883 | 26,074 | 30,810 | 35,911 | 47,740 |
| 1978 | 33,630 | 42,743 | 25,151 | 34,918 | 27,351 | 24,449 | 33,735 | 38,468 | 34,100 | 26,805 | 31,300 | 36,327 | 47,910 |
| 1979 | 33,709 | 42,661 | 25,301 | 34,990 | 27,698 | 24,733 | 33,966 | 38,241 | 34,207 | 26,950 | 31,180 | 36,116 | 47,962 |
| 1980 | 32,825 | 41,283 | 24,936 | 34,237 | 26,563 | 23,708 | 33,306 | 37,279 | 33,423 | 25,591 | 30,352 | 35,274 | 47,256 |
| 1981 | 32,819 | 41,445 | 24,742 | 34,359 | 26,166 | 23,411 | 32,940 | 37,699 | 33,619 | 25,297 | 30,177 | 35,188 | 47,199 |
| 1982 | 33,041 | 40,958 | 25,601 | 34,588 | 26,512 | 22,908 | 33,099 | 38,162 | 34,171 | 24,937 | 30,163 | 35,092 | 47,661 |
| 1983 | 33,133 | 40,934 | 25,798 | 34,680 | 26,688 | 22,479 | 33,225 | 38,409 | 34,081 | 24,715 | 29,752 | 34,721 | 48,951 |
| 1984 | 34,075 | 42,059 | 26,531 | 35,815 | 27,380 | 22,909 | 33,803 | 39,519 | 35,521 | 25,217 | 30,632 | 35,701 | 49,722 |
| 1985 | 34,034 | 41,988 | 26,473 | 35,836 | 27,276 | 22,542 | 33,911 | 39,894 | 34,565 | 24,764 | 29,981 | 35,773 | 50,743 |
| 1986 | 35,041 | 43,034 | 27,448 | 37,036 | 27,790 | 22,201 | 34,854 | 41,540 | 35,166 | 24,816 | 30,963 | 36,499 | 52,195 |
| 1987 | 35,143 | 42,823 | 27,842 | 37,116 | 28,199 | 23,041 | 34,362 | 41,344 | 36,164 | 25,247 | 31,062 | 36,469 | 51,617 |
| 1988 | 35,128 | 42,559 | 28,030 | 37,088 | 28,361 | 22,387 | 34,343 | 41,314 | 36,063 | 24,454 | 30,699 | 36,468 | 52,005 |
| 1989 | 35,040 | 42,169 | 28,214 | 37,074 | 28,133 | 22,191 | 34,129 | 41,196 | 35,888 | 24,089 | 30,368 | 36,282 | 52,062 |
| 1990 | 34,136 | 40,669 | 27,861 | 36,261 | 27,057 | 21,522 | 33,031 | 40,235 | 35,077 | 23,300 | 29,568 | 35,146 | 50,820 |
| 1991 | 34,092 | 40,515 | 27,940 | 36,087 | 27,601 | 21,223 | 32,859 | 40,392 | 34,387 | 22,754 | 29,327 | 33,382 | 51,675 |
| 1992 | 34,372 | 40,459 | 28,495 | 36,467 | 27,697 | 21,446 | 32,919 | 40,340 | 35,537 | 22,770 | 29,659 | 33,330 | 51,254 |
| 1993 | 34,287 | 40,083 | 28,624 | 36,603 | 27,329 | 20,787 | 32,736 | 40,594 | 35,405 | 21,908 | 29,167 | 33,058 | 52,117 |

(continued)

**Table B.7 (continued)**

| Year | Total | Men | Women | White | Nonwhite | 18–24 | 25–39 | 40–54 | 55–64 | Less than HS | HS graduate | Some college | College graduate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1994 | 34,639 | 40,443 | 28,970 | 37,021 | 27,569 | 20,303 | 33,041 | 40,887 | 36,099 | 22,016 | 29,299 | 33,359 | 52,134 |
| 1995 | 35,504 | 42,415 | 28,788 | 38,303 | 27,650 | 20,514 | 33,360 | 42,144 | 37,506 | 22,377 | 29,467 | 33,701 | 54,524 |
| 1996 | 35,824 | 42,251 | 29,549 | 38,614 | 28,267 | 20,997 | 34,035 | 42,138 | 36,728 | 22,004 | 29,879 | 34,044 | 54,871 |
| 1997 | 37,067 | 44,004 | 30,329 | 40,129 | 28,957 | 21,715 | 34,922 | 43,197 | 39,209 | 23,487 | 30,794 | 35,128 | 55,771 |
| 1998 | 38,001 | 44,679 | 31,531 | 41,171 | 29,669 | 22,431 | 35,900 | 43,898 | 40,704 | 23,179 | 31,173 | 35,698 | 57,749 |
| 1999 | 38,189 | 45,126 | 31,491 | 41,402 | 29,982 | 21,944 | 36,059 | 44,541 | 39,938 | 22,706 | 30,878 | 35,923 | 58,246 |
| 2000 | 39,138 | 46,505 | 32,058 | 42,662 | 30,365 | 23,338 | 36,994 | 45,206 | 41,038 | 23,035 | 31,552 | 36,558 | 59,468 |

**Table B.8 Capacity Utilization Rates, Total and Various Groups, 1975 and 2000**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | CUR | Percent of population CUR | CUR | Percent of population CUR | Percent change in CUR |
| Total (Working-age population) | 0.62 | 100 | 0.72 | 100 | 17.0 |
| By sex | | | | | |
| Men | 0.75 | 122 | 0.81 | 111 | 6.8 |
| Women | 0.41 | 66 | 0.61 | 84 | 49.9 |
| By race | | | | | |
| Whites | 0.63 | 101 | 0.73 | 101 | 16.3 |
| Nonwhites | 0.57 | 92 | 0.71 | 98 | 24.2 |
| By age | | | | | |
| 18–24 | 0.54 | 87 | 0.60 | 83 | 10.7 |
| 25–39 | 0.68 | 109 | 0.79 | 108 | 16.3 |
| 40–54 | 0.64 | 103 | 0.75 | 103 | 17.8 |
| 55–64 | 0.52 | 84 | 0.58 | 80 | 10.9 |
| By years of schooling | | | | | |
| Schooling = <12 years | 0.48 | 78 | 0.49 | 67 | 0.8 |
| Schooling = 12 years | 0.61 | 98 | 0.64 | 89 | 6.0 |
| Schooling = 13–15 years | 0.65 | 106 | 0.73 | 101 | 11.3 |
| Schooling = 16 years or more | 0.77 | 124 | 0.82 | 113 | 7.1 |

**Table B.9 Capacity Utilization Rates, Total and Various Groups by Sex, 1975 and 2000**

| | 1975 | | 2000 | | |
|---|---|---|---|---|---|
| | CUR | Percent of population CUR | CUR | Percent of population CUR | Percent change in CUR |
| Total (Working-age population) | 0.62 | 100 | 0.72 | 100 | 17.0 |
| Men | 0.75 | 122 | 0.81 | 111 | 6.8 |
| White | 0.76 | 123 | 0.81 | 112 | 6.5 |
| Nonwhite | 0.70 | 112 | 0.78 | 108 | 12.4 |
| Age 18–24 | 0.61 | 99 | 0.63 | 87 | 3.1 |
| Age 25–39 | 0.83 | 134 | 0.88 | 121 | 5.5 |
| Age 40–54 | 0.78 | 125 | 0.83 | 115 | 6.9 |
| Age 55–64 | 0.63 | 102 | 0.66 | 91 | 4.1 |
| Schooling = <12 years | 0.62 | 100 | 0.59 | 81 | –5.4 |
| Schooling = 12 years | 0.76 | 123 | 0.71 | 98 | –6.7 |
| Schooling = 13–15 years | 0.77 | 125 | 0.80 | 111 | 3.4 |
| Schooling = 16 years or more | 0.86 | 138 | 0.91 | 126 | 6.2 |
| Women | 0.41 | 66 | 0.61 | 84 | 49.9 |
| White | 0.41 | 65 | 0.61 | 84 | 50.0 |
| Nonwhite | 0.42 | 68 | 0.62 | 86 | 47.4 |
| Age 18–24 | 0.45 | 73 | 0.56 | 77 | 23.7 |
| Age 25–39 | 0.43 | 70 | 0.67 | 92 | 54.2 |
| Age 40–54 | 0.40 | 64 | 0.63 | 87 | 58.5 |
| Age 55–64 | 0.34 | 54 | 0.45 | 62 | 33.7 |
| Schooling = <12 years | 0.27 | 44 | 0.35 | 48 | 28.8 |
| Schooling = 12 years | 0.41 | 66 | 0.55 | 76 | 34.0 |
| Schooling = 13–15 years | 0.46 | 74 | 0.64 | 88 | 40.0 |
| Schooling = 16 years or more | 0.56 | 90 | 0.69 | 95 | 23.0 |

**Table B.10 Capacity Utilization Rates, Total and Various Groups, 1975–2000**

| | | Sex | | Race | | Age | | | | Education | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Total | Men | Women | White | Non-white | 18–24 | 25–39 | 40–54 | 55–64 | Less than HS | HS graduate | Some college | College graduate |
| 1975 | 0.62 | 0.75 | 0.41 | 0.63 | 0.57 | 0.54 | 0.68 | 0.64 | 0.52 | 0.48 | 0.61 | 0.65 | 0.77 |
| 1976 | 0.61 | 0.74 | 0.41 | 0.62 | 0.58 | 0.56 | 0.66 | 0.63 | 0.52 | 0.50 | 0.60 | 0.64 | 0.74 |
| 1977 | 0.62 | 0.75 | 0.42 | 0.63 | 0.60 | 0.57 | 0.68 | 0.64 | 0.51 | 0.50 | 0.61 | 0.64 | 0.75 |
| 1978 | 0.63 | 0.75 | 0.44 | 0.63 | 0.61 | 0.60 | 0.69 | 0.63 | 0.51 | 0.49 | 0.62 | 0.65 | 0.75 |
| 1979 | 0.63 | 0.74 | 0.46 | 0.64 | 0.60 | 0.59 | 0.69 | 0.64 | 0.51 | 0.49 | 0.62 | 0.66 | 0.75 |
| 1980 | 0.62 | 0.73 | 0.46 | 0.63 | 0.59 | 0.57 | 0.68 | 0.64 | 0.50 | 0.47 | 0.61 | 0.65 | 0.74 |
| 1981 | 0.62 | 0.72 | 0.46 | 0.63 | 0.59 | 0.55 | 0.68 | 0.64 | 0.50 | 0.47 | 0.60 | 0.64 | 0.75 |
| 1982 | 0.60 | 0.70 | 0.46 | 0.61 | 0.57 | 0.52 | 0.66 | 0.63 | 0.48 | 0.43 | 0.58 | 0.62 | 0.75 |
| 1983 | 0.61 | 0.70 | 0.47 | 0.62 | 0.57 | 0.52 | 0.66 | 0.64 | 0.48 | 0.43 | 0.58 | 0.64 | 0.73 |
| 1984 | 0.62 | 0.71 | 0.48 | 0.63 | 0.58 | 0.53 | 0.68 | 0.64 | 0.48 | 0.44 | 0.59 | 0.63 | 0.75 |
| 1985 | 0.64 | 0.73 | 0.50 | 0.65 | 0.60 | 0.55 | 0.70 | 0.66 | 0.49 | 0.44 | 0.61 | 0.66 | 0.76 |
| 1986 | 0.64 | 0.73 | 0.51 | 0.65 | 0.61 | 0.57 | 0.70 | 0.66 | 0.50 | 0.46 | 0.61 | 0.66 | 0.76 |
| 1987 | 0.65 | 0.73 | 0.52 | 0.65 | 0.62 | 0.56 | 0.70 | 0.68 | 0.47 | 0.46 | 0.62 | 0.67 | 0.76 |
| 1988 | 0.66 | 0.75 | 0.54 | 0.67 | 0.63 | 0.59 | 0.72 | 0.69 | 0.48 | 0.46 | 0.63 | 0.68 | 0.76 |
| 1989 | 0.67 | 0.75 | 0.55 | 0.67 | 0.63 | 0.60 | 0.72 | 0.69 | 0.49 | 0.45 | 0.64 | 0.69 | 0.77 |
| 1990 | 0.66 | 0.74 | 0.55 | 0.67 | 0.63 | 0.56 | 0.72 | 0.69 | 0.49 | 0.46 | 0.63 | 0.69 | 0.76 |
| 1991 | 0.65 | 0.72 | 0.56 | 0.66 | 0.61 | 0.55 | 0.70 | 0.68 | 0.49 | 0.42 | 0.61 | 0.70 | 0.74 |
| 1992 | 0.65 | 0.72 | 0.55 | 0.66 | 0.60 | 0.53 | 0.70 | 0.68 | 0.49 | 0.41 | 0.59 | 0.69 | 0.75 |
| 1993 | 0.65 | 0.72 | 0.56 | 0.66 | 0.61 | 0.54 | 0.71 | 0.68 | 0.48 | 0.41 | 0.59 | 0.68 | 0.74 |

(continued)

**Table B.10 (continued)**

| Year | Total | Sex | | Race | | Age | | | | Education | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Men | Women | White | Non-white | 18–24 | 25–39 | 40–54 | 55–64 | Less than HS | HS graduate | Some college | College graduate |
| 1994 | 0.66 | 0.74 | 0.56 | 0.67 | 0.63 | 0.57 | 0.72 | 0.69 | 0.50 | 0.44 | 0.61 | 0.69 | 0.76 |
| 1995 | 0.70 | 0.78 | 0.59 | 0.71 | 0.65 | 0.57 | 0.75 | 0.73 | 0.55 | 0.45 | 0.63 | 0.72 | 0.80 |
| 1996 | 0.71 | 0.79 | 0.59 | 0.72 | 0.67 | 0.56 | 0.74 | 0.74 | 0.57 | 0.47 | 0.64 | 0.73 | 0.80 |
| 1997 | 0.70 | 0.77 | 0.59 | 0.70 | 0.67 | 0.57 | 0.74 | 0.73 | 0.55 | 0.46 | 0.62 | 0.70 | 0.80 |
| 1998 | 0.70 | 0.78 | 0.59 | 0.71 | 0.67 | 0.59 | 0.75 | 0.73 | 0.56 | 0.47 | 0.62 | 0.71 | 0.80 |
| 1999 | 0.71 | 0.78 | 0.61 | 0.71 | 0.69 | 0.58 | 0.77 | 0.72 | 0.57 | 0.48 | 0.64 | 0.72 | 0.79 |
| 2000 | 0.72 | 0.81 | 0.61 | 0.73 | 0.71 | 0.60 | 0.79 | 0.75 | 0.58 | 0.49 | 0.64 | 0.73 | 0.82 |

# Appendix C

## Attribution of Unrealized Potential Earnings to Its Sources

This appendix describes the procedures employed in allocating hours not spent in work activities. Ultimately, we create six categories of unrealized potential earnings: unemployment, illness/disability, retirement, voluntary part-time work, housework, and other.

Respondents to the CPS who do not work FTFY are asked a series of questions concerning the reasons for such labor force attachment. First, part-year workers and nonworkers are asked the number of weeks spent in the labor force looking for work. Second, these workers are asked their primary activity during the remaining weeks they did not work or look for work.

The set of responses is

- unemployed,
- ill or disabled,
- engaged in home activities,
- retired, and
- other.

Home activities and retirement are considered voluntary reasons for part-year work, while unemployment and illness are considered involuntary reasons. Other is not included in either category. Third, part-time workers are asked the primary reason for part-time work. Here, the set of responses is limited: could only find part-time work, slack work demand, and wanted part-time work. Slack work demand and the inability to find full-time work are considered involuntary reasons for less than full-time work, while wanting part-time work is considered a voluntary reason. Workers can work both part time and part year.

### FULL-TIME, PART-YEAR WORKERS AND NONWORKERS

Consider first individuals who work part year or not at all. These individuals report the number of weeks spent in the labor force not working but looking for work (unemployed). Assuming 40 hours per week, we calculate the number of hours spent unemployed as 40 times the number of weeks spent un-

employed. Depending on the individual's responses to other questions, we may add additional hours to this unemployment total.

We next examine the individual's activities during the remaining weeks of the year. For part-year workers, these are the weeks remaining after working and looking for work. For nonworkers these are simply the weeks remaining after looking for work. As noted above, the potential activities are unemployed, ill or disabled, engaged in home activities, retired, and other. At 40 hours per week, we calculate the total hours spent in any particular activity. To summarize, for any activity other than unemployment,

$$\text{part-year hours in the activity} = 40 \times \text{weeks in the activity.}$$

For unemployment,

$$\text{part-year hours unemployed} = 40 \times (\text{weeks in the labor force looking for work} + \text{remaining weeks with unemployed as a primary activity}).$$

## PART-TIME, FULL-YEAR WORKERS

Next we examine the individual's hours spent outside of part-time work—that is, those hours spent not working during the weeks he or she is engaged in part-time (as opposed to part-year) work. First consider those individuals who engage in part-time work for a full year. These individuals are asked why they worked part time. As noted above, the three possible responses are: could only find part-time work, slack work demand, and wanted part-time work.

The first two responses can be considered "involuntary" reasons for working only part time. Certainly, the sense of "slack work" is that the individual wanted to work full time but could not due to local economic conditions. Similarly, "could only find part-time work" implies that the individual has looked for and wants full-time work. Therefore, for individuals offering these responses, we attribute their part-time hours to "unemployment," and calculate them as the number of hours per week worked during the weeks worked part time multiplied by the number of weeks in part-time work (both of which are reported in the CPS).

For individuals who "wanted part-time work," we create a new category called "voluntary part-time work." Since we have no further information on the reasons these individuals worked part time, we cannot allocate these part-time hours to any particular category. The individual could have engaged in home activities, or could be "semi-retired," volunteering at a nursing home in the morning and working in the afternoon. Similarly, an individual with an ill-

ness or disability may be able to maintain a full-year job but choose to work half a day.

## PART-TIME, PART-YEAR WORKERS

Finally, we examine individuals who work part time, part year. Since these individuals work part year, we have responses to the questions concerning activities during weeks not working or looking for work mentioned above. We use this information to supplement the answers to the reasons for working part time in allocating such part-time hours. First, individuals who report "slack work" as a reason for working part time have their part-time hours allocated to "unemployment," regardless of the reason given for working part year. Second, individuals who report "wanted part-time work" have their part-time hours allocated to "voluntary part-time work" unless they report "housework" as the reason for working part year. Those individuals have their part-time hours allocated to housework. Finally, individuals who report "could only find part-time work" have their part-time hours allocated to "unemployment" unless the reason for working part year is "illness or disability." These individuals have their part-time hours allocated to "illness or disability." The assumption here is that since the illness or disability prevented the individual from working full year, it also prevented him or her from working full time.

## SUMMARY

To summarize, for any activity $a$, other than unemployment,

$$H_a = 40 \times (50 - W_w - W_l) + (40 - H_{pt}) \times W_{pt},$$

where $H_a$ is hours allocated to activity $a$, $W_w$ is the weeks spent working, $W_l$ is the weeks spent looking for work, $H_{pt}$ are the hours usually worked during part-time work weeks, and $W_{pt}$ are the weeks worked part time. Note that an individual can give at most one answer for the reason working part year (or not at all) and for the reason working part time. Finally, in keeping with our 2,000 hour FTFY norm, we assume a maximum of 40 hours of work per week and 50 weeks of work per year.

For activity $a$ = unemployment,

$$H_a = 40 \times (50 - W_w) + (40 - H_{pt}) \times W_{pt}.$$

Tables C.1 and C.2 summarize the allocation of hours for part-time, full-year workers and part-time, part-year workers.

**Table C.1 Allocation of Part-Time Hours for Part-Time, Full-Year Workers**

| | Could only find PT work | Wanted PT work | Slack work |
|---|---|---|---|
| Allocate PT hours to | Unemployment | Voluntary PT work | Unemployment |

NOTE: These workers do not work part-year and, hence, have no part-year reason given

**Table C.2 Allocation of Part-Time Hours for Part-Time, Part-Year Workers**

| | Part-time reason given | | |
|---|---|---|---|
| Part-year reason given | Could only find PT work | Wanted PT work | Slack work |
| Illness/disability | Illness | Voluntary PT work | Unemployment |
| Housework | Unemployment | Housework | Unemployment |
| Unemployment | Unemployment | Voluntary PT work | Unemployment |
| Retirement | Unemployment | Voluntary PT work | Unemployment |
| Other | Unemployment | Voluntary PT work | Unemployment |

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